SCIENCE.

FRIDAY, JUNE 20, 1884.

COMMENT AND CRITICISM.

COMMENTS and criticisms, at this season, turn naturally toward the schools and colleges which are holding their annual assemblies, and bestowing their academic honors. A year ago, at Harvard, a vigorous speaker applied the match to materials which proved to be very explosive; and since then we have had a succession of arguments, public and private, with appeals to the law and to the testimony, European and American, respecting the value of different branches of knowledge, and the proper order of studies. Having read the various pamphlets and magazine articles which have appeared on this subject by Adams, Hofmann, White, Dyer, James, Fisher, Sumner, and Eliot, and many others; having watched the controversy, carried on in the newspapers, — it seems to us that the discussion, though rather monotonous to those who have previously thought it out, has been timely, vigorous, and useful. Probably the leaders of the battle have not in the least changed their opinions; but we think that the educated public has a clearer notion of the meaning of a liberal education, and that sounder views upon the relations of literature and science are likely to prevail, as a result of this discussion.

As to ancient life and letters, it is obvious that more and more is to be done in this country for their study. Classical teachers, conscious of the deficiencies of former days, are endeavoring to secure more enthusiasm and higher scholarship by the use of better text-books, better methods of instruction, and ampler means of illustration; and, with great advantage both to teachers and pupils, they are eliminating from the classical classrooms, by various regulations, those who can not, or will not, or do not, learn their Greek and Latin. The country will certainly gain by this.

But the Greek question, as it is called, is only one phase of the movement: there is an increasing zest in the study of antiquity, — in whatever interprets the history of mankind. The work of Baird, Powell, Mallory, Brinton, Bandelier, and of many others, is illuminating the records of the savage life and of the early civilizations in this country. The establishment of an Archeological institute of America, and the opening of an American school of classical studies in Athens, are indications of activity in the field of classical inquiry. The lectures given in various cities last winter — by Clarke on his exploration of Assos, by Waldstein on Greek archeology, and by Stillman on his studies in the Levant — are similar signs. Before many months have passed, a distinguished archeologist from Rome, the explorer of the Forum, will be lecturing among us. Collections of casts and photographs and coins are now to be found near all our classical colleges. The *American journal of philology* has reached its sixth volume, with marks of increasing value, and without drawing off material from the American oriental and the American philological societies. Even Assyrian antiquities are receiving the most serious attention in this country from men trained in Germany, and acknowledged to be most competent for the interpretation of cuneiform inscriptions. All these facts are indications to our minds that the study of antiquity is in no danger at present of being undervalued by Americans. Certainly the lovers of Greek culture need not be alarmed; for the flower of ancient literature and art will surely not be slighted by an intelligent community, once fully awakened to the study of the remote past.

On the other hand, the claims of science are receiving more and more recognition. The great laboratories begun or completed within the year at Cambridge, New Haven, Baltimore, and Ithaca, are signs, which everybody can

understand, that the physical and natural sciences are more than ever to be encouraged. Original researches are in progress in private and in public laboratories to an extent unknown among us a few years ago. More ample means of publication, especially in subjects which require costly illustration, are loudly called for. Three or four such memoirs proceeding from American laboratories have been offered to the Royal society in London, and have been ordered to be printed in their Proceedings, because there was no place for them here. The national government, with a parsimonious hand, but still with increasing wisdom, is providing for such scientific publications as are more or less pertinent to the public service. Schools of technology are increasing in number and in power. It is more and more openly asserted, that no one in these days is receiving a truly liberal education, unless he adds to mathematics and languages an acquaintance with at least one branch of scientific inquiry, derived in part from work in a laboratory, and from personal observation of the methods of research. Seaside laboratories at Newport, Wood's Holl, Annisquam, and Beaufort, are giving facilities for the study of life at the seashore, as years ago opportunities were given in the interior to the student and collector of fossils.

As we look at the situation, and recall such facts as we have stated, we believe that in American education the claims of literature and science are fairly adjusted. More ought to be done in both directions. The richest of our colleges are poor. Were the income of Harvard to be doubled, every dollar could be well employed at once. Were there to be a dozen Harvards and Yales, with plans as wise as those which have governed these old foundations, and with means as ample, the country would reap thebenefits .

IF the excellent recommendations made by the National academy of sciences five or six years ago had then been fully adopted by congress, we should probably have been spared the present suggestion to a congressional committee, that the work of the coast-survey should be divided ; the hydrography and coast triangulation to be assigned to the hydrographic office of the navy department, and the geodetic work to the geological survey of the interior department. It was by the advice of the academy that the present geological survey arose, practically by the consolidation of three previously existing organizations. And in its memorandum, drawn up with great care and skill, the academy recommended that the coast-survey should be transferred to the interior department, "retaining its original field of operations, and assuming also the entire mensuration of the public domain; and that, so modified and extended, it hereafter be known as the U. S. coast and interior survey."

The purpose of the academy was plain, — to bring together, under one department, the coast (and interior) survey, for the mensuration and mapping of the country; the geological survey, for the study of its geological structure and natural resources; and the land-office, for the disposition and sale of public lands. The two latter would require their own maps, based upon geodetic points furnished by the first; and the land-office could obtain from the geological survey all the information it required as to the value and classification of lands. The entire survey of the public domain would thus fall, as is proper, under one department; and that co-ordination of work and mutual co-operation imperatively required would be obtainable without difficulty, and with the least waste.

In no event should the work of the coast-survey be divided : it forms an harmonious and congruous whole. Hydrography must be based on geodetic work. Submarine topography is important to an understanding of the structure of a continent. Nor is a geological survey deeply concerned in the niceties of refined geodetic measurements, nor in geodetic questions as such. For its purposes, work of a more rapid and superficial kind suffices ; and it were much to be feared, that, in its subordination to

the geological survey, the excellence of the work of our coast-survey, now justly the highest pride of our nation's science, would deteriorate. As it stands, it may fearlessly challenge comparison with similar work by any European nation in precision, elegance, and economy. Its work is for all time.

A RECORD of the opening and closing of navigation at York Factory, Hudson's Bay, extending from 1828 to 1880, has been communicated by W. Woods of the Hudson's-Bay company. The latest date of open water in spring is June 1; the earliest closing of navigation, Nov. 3. The earliest opening was May 4; the latest closing, Dec. 9. The season, then, extends over from five to seven months, with an average of six months open water. The time when navigation would be available is limited, however, by the time of open water in Hudson's Straits, by which the bay is reached. This comprises only July, August, and September, and possibly part of October; but exact advices are not yet attainable. The question of the navigability of the Hudson's-Bay route to Europe is of vast importance for the settlers of Manitoba and the Saskatchewan; since, if it be available, they can, by a comparatively short railway-transit, reach tidewater with their crops, which otherwise cannot possibly compete with those of the north-western United States. It is understood that a trial is to be made of the route, and that a reconnoissance of Hudson's Bay, of which there are no good charts, will shortly be attempted.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The deep-sea fish, Malacosteus.

IN reading the translation of Mr. Filhol's article on the deep-sea fishes collected by the Talisman (*Science*, May 23), I have been somewhat surprised by recognizing, in A. Tissandier's figure of Malacosteus niger, an old acquaintance, the source of which may be observed in *Bost. journ. nat. hist.*, vi. plate v.

While upon this subject of Malacosteus, it may be interesting to note, that, in several specimens of M. niger now in the National museum, the slender band connecting the tongue with the mandibular symphysis, which has long been regarded as a tangled hyoid barbel, is really not free at either end, and may be only a muscle concerned in the movement of the lower jaw. I have not yet been able to find a true hyoid barbel. The pectoral contains three rays instead of five, as counted by Dr. Ayres; and the caudal is forked, and not convex.

TARLETON H. BEAN,
Curator department of fishes.

U. S. national museum, May 28.

[By an oversight on our part, we neglected to state that the illustrations of the two articles in No. 68 on deep-sea fishes were copied in part from *La Nature*, and in part from *Science et nature*. Those on p. 621 came from the latter journal, the others from the former, but not all of them in connection with the article translated. — ED.]

A bad habit of the fox-squirrel (Sciurus niger, var. ludovicianus).

Madison people pride themselves not a little on the number and tameness of their fox-squirrels, which are found by scores in the shade-trees of the capitol park and the residence streets of the city. Protected by a special ordinance, they have multiplied rapidly, and scarcely know what fear is, running along before one, on the sidewalk or fence, and occasionally even stopping, and allowing themselves to be touched, in the hope of getting a nut. We consider them decidedly more ornamental and worthy of good treatment than the ubiquitous blue-jay or sparrow, and never tire of watching their pretty ways. But to-day I noticed several engaged in far less commendable business than hiding, or opening acorns.

While passing under a row of elms, my attention was attracted by a number of short twigs lying on the sidewalk. About a hundred were counted under the first tree. They were of nearly uniform size, six or eight inches long, including the young growth of the season and a short piece of last year's wood, with one or two bunches of the nearly ripe fruit.

After a gale in the early fall, the ground under the white elms is sometimes covered with leafy branches of about the same size, which separate by a joint at the site of a former winter bud, like the so-called brittle branches of poplars and willows, which they also resemble in being a sort of natural cuttings, serving in part for propagation.[1] In the present instance, however, the ends of the twigs did not show the smooth surface of those which fall naturally; and, as there was no indication of the work of a pruner, I turned my attention to the top of the tree, where it was directed by a twig falling just as I looked up. Following its course, I saw a squirrel, comfortably seated on one of the upper branches, busily at work on the fruit of a second twig, which was soon dropped for another. No less than five were broken off in a single minute; and, while I watched, the falling twigs averaged one a minute. They were dexterously snapped off just below the fruit-cluster, a bite or two often helping in the operation. The seed was removed from each of the small samaras by a single adroit cut on one side; and, long before the rifled branch had reached the ground, another was undergoing the same fate. The dinner of this one squir-

[1] Frank devotes a few pages of his Krankheiten der pflanzen (pp. 34, 35) to this spontaneous pruning, which he considers a means of removing weakly twigs, after their vegetative period is ended. Its occurrence is mentioned as especially noticeable in Taxodium, Quercus, Populus, and Salix, but not by any means confined to these genera.

rel resulted in the pruning of over two hundred branches. A great many other trees showed equal evidence of the relish of squirrels for the seed, which they all obtained in the same wasteful manner; but this destruction can last only a short time, as the fruit falls very promptly when ripe.

WM. TRELEASE.

Madison, Wis., May 24.

The claims of political science.

Is there any valid reason why political science should not take its natural place among the sciences? That it has no such place is evident from the fact that it is almost wholly excluded from all the scientific journals that profess to be devoted to all the sciences. How many articles on political science have ever appeared in the *American journal of science*, in *Nature*, in *Science?* Can any other science be named of which the same can be said? It seems to be assumed that all that is ever said about national affairs must necessarily be of a partisan character, and be said, not for the sake of truth, but to serve some political party or private interest. Yet any one who has any faith in humanity must admit that a large amount of disinterested political work is being done. Those who deny this for the present will generally admit it for the past, and the present is always becoming the past. But, even if this were not the case, it would still be true that scientific politics is theoretically possible.

Most sciences are more or less practical; i.e., they furnish the principles which underlie the useful arts. From pure science to pure art there are always three somewhat distinct steps. The first is the *discovery* of scientific principles; the second is the *invention* of the methods of applying these principles; and the third is the actual *application* of the principles. The first two or the last two of these steps may sometimes be so intimately blended as to render it difficult to detect the line of demarcation between them; but theoretically the three steps are always present.

If, therefore, there is a political science, this must also be true of it. We will assume that there is such a science; that the operations of a state constitute a department of natural phenomena, which, like other natural phenomena, take place according to uniform laws. The pure science, then, consists in the discovery of these laws. The intermediate, or inventive, stage embraces the devising of methods for controlling the phenomena so as to cause them to follow advantageous channels, just as water, wind, and electricity are controlled. The third stage is simply the carrying-out of the methods thus devised.

Political science is one of the cases in which, in its present state at least, the first and second steps are very much blended. They are both embraced in legislation, which includes both discovery and invention. Yet the pure investigator is not entirely wanting; and the *ideal politician* or statesman would correctly represent the first stage, or pure political science. The executive branch of government fairly coincides with the third, or pure art, stage. The judiciary is properly legislative or inventive; but, in fact, it often performs executive or technologic functions.

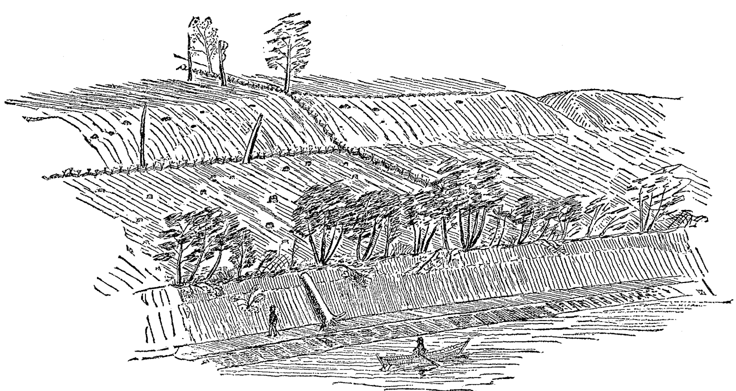
Why, then, does not politics form a legitimate subject of scientific investigation? Why might not its discussion in strictly scientific societies and journals be permitted and encouraged? And would not this be one of the best checks that could be set to the mad surge of unreasoning partisanship that now fills the columns of the public press?

It will probably be replied, that, the moment a scientific man should attempt to discuss current political issues, he would lose his scientific attitude and spirit. Were he to do so, he would certainly forfeit the respect and confidence of scientific men; but this would be contrary to our hypothesis that the discussion be scientific.

LESTER F. WARD.

Some Indiana glaciology.

In *Science*, No. 22, I gave some account of certain glacial scratches in Montgomery county which showed a trend approximately at right angles to the direction of the first, or at least a former glacier. Since that date I have made a more thorough study of the region with much better instruments, and the results are worth recording. In the short note referred to, it is stated that Sugar Creek, a large eastern tributary of the Wabash, has a general south-westerly course through the county, about parallel with that of the Wabash, twenty or thirty miles to the north. In the bed of this stream there are glacial scratches, indicating a movement parallel with its course, referred to the first or Lake Erie glacier, whose course across the state, up the Maumee and down the Wabash, has been plainly shown. In the north-eastern part of the county, near the junction of Sugar and Lye creeks, the former stream runs along a ledge of subcarboniferous sandstone, which forms its northern bank. This



ledge is from three to five feet above average water-level, has no representation on the southern bank, and is exposed for perhaps a mile. Upon uncovering its surface, it is found to be planed as smooth as a floor, and deeply and closely grooved with glacial scratches, which trend directly across the stream and the course of the old glacier. The sandstone is, for the most part, fine-grained; but in some places it contains numerous small geodes, which beautifully indicate the direction of flow, each having a struck side to the north, and a protected sandstone ridge to the south. On top of the platform there lies a typical moraine, whose trend, being about at right angles to the scratches, indicates a terminal moraine. A section showed the following results: stiff blue clay, with

scratched pebbles and small bowlders, six to eleven feet; fine sand and gravel to the top of a terrace, five feet; height of moraine above terrace, forty feet. The terrace platform spoken of is about eight hundred feet wide. (The accompanying sketch indicates these features, as seen from the creek.) At three stations along the ledge, a large area of the platform was uncovered for the purpose of measuring the angle of direction over as long lines of striation as possible. Repeated observations, corrected for magnetic variation, gave the following result: at the eastern station the direction of the scratches was N. 27° 50′ W.; a little over half a mile west, they were N. 23° 50′ W.; about an eighth of a mile farther west, N. 22° 30′ W. These differences were very unexpected, and hence great care was taken to obtain them accurately. Such angles would indicate a focal point only a few miles to the north-west. In looking over the topography of northern Indiana, it is a remarkable fact, that a ridge of limestone extends across the state, running with the Wabash valley in its eastern section, but striking more westerly in the western part of the state, leaving the Wabash to the south. North of this east and west ridge is a region of marshes and deep sand-deposits, extending to the northern boundary: south of it are more drift-deposits, but not so deep. It seems very probable that a former extension of Lake Michigan found its southern boundary in the neighborhood of this ridge. As the converging lines of our glacial platform seemed to find their centre in the neighborhood of this ridge, it seemed to suggest some relation between them. The first overwhelming flow was parallel with the ridge, and so we find the lower scratches in the Wabash and in Sugar Creek. But afterwards, in the retreat of the great glacier, there seem to have been some local centres along this ridge, which sent out small fan-shaped glaciers with rapidly diverging lines. No other explanation seems to satisfy the angles obtained in this case. Virtually nothing has been done in this state in the way of collecting the facts of the drift; and there is every indication that our relation to the Great Lakes and the peninsula of Michigan, besides the internal features already indicated, present some very interesting and important problems. The legislature of a great educational state cannot yet be induced to appropriate a dollar for any survey which does not deal with the location and thickness of coal-seams and limestone-beds.

JOHN M. COULTER.

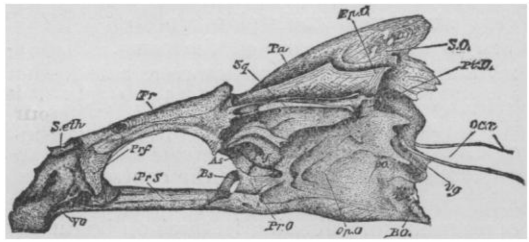
Wabash college, Crawfordsville, Ind.

Osteology of Micropterus salmoides.

I was very sorry to find from reading Mr. McMurrich's letter in *Science*, No. 69, that its author had derived nothing but the most erroneous ideas from my description of a pair of free ribs at the base of the occiput of Micropterus (*Science*, No. 65).

As Mr. McMurrich remarks, it was unfortunate that he was not able to dissect a specimen of the black bass, for the very good reason — which applies more particularly to anatomy — that one should certainly examine, in any case, structures under consideration, before publishing about them, and advancing suggestions as to what they may possibly be. Even where an author specifies that he has not seen the thing whereof he writes, people are often misled. On the other hand, I was glad to see the interest these structures awakened, and will look forward with no little pleasure to Mr. McMurrich's observations upon them, after he has had an opportunity to make a thorough examination.

As an anatomical description is made far clearer when accompanied by a drawing of the parts discussed, I determined, upon seeing Mr. McMurrich's letter, to follow that rule in the present instance, in my reply to it. To this end, I selected from my private collection a very fine cranium of Micropterus, with a pair of well-developed ribs attached to it. From this specimen I made the drawing that illustrates this letter.



Left lateral view of cranium of Micropterus salmoides, showing a pair of ribs at the occiput (from nature, half size, linear). *S eth*, supra-ethmoid; *Fr*, frontal; *Sq*, squamosal; *Pa*, palatine (not well in sight); *Ep O*, epiotic; *SO*, super-occipital; *Pt O*, pterotic; *Oc r*, occipital ribs; *vg*, foramen for vagus; *EO*, ex-occipital; *BO*, basi-occipital; *Op O*, opisthotic; *Pr O*, pro-otic; *Ptf*, post-frontal; *As*, ali-sphenoid; *Bs*, basi-sphenoid; *Pr S*, para-sphenoid; *Prf*, pre-frontal; *Vo*, vomer.

From this it is very evident that these ribs are not 'portions or rudiments of the supraclaviculae,' but really have all the characteristics of the ribs upon the atlas and axis. I have never found epipleural appendages attached to them, as I believe may occur on the first two ribs of the column. Dr. Sagemehl, in his valuable paper on the cranium of Amia (*Morphologisches jahrbuch*, ix.), is very explicit in what he says about the co-ossification of the three vertebrae with the basi-occipital of this ganoid; and if this author had been aware of such a state of affairs as I here figure, in any of the Teleostei, he certainly would have brought it forward in connection with the discussion of that subject. They are two very significant facts, that these ribs in Micropterus articulate *beyond* the vagus foramen, and that they are apparently constant. I have since found similar structures in a specimen of Orcynus thynnus, and rather suspect it in the Scombridae, though the specimens at my command, illustrating this latter group, were so poorly prepared, I could not satisfy myself in regard to them. It will be of great interest and importance to examine, in this particular, forms more or less nearly related to Micropterus, and the young of all, at various stages. Of their nature, I think it may be said without doubt, that they are a pair of true ribs, agreeing in all important particulars with the abdominal ribs, as seen in the pairs on the atlas and axis; that they belong to the same series, and articulate with the occiput, to which they belong; and that they are a constant character.

I should be rather surprised to find that these structures had not been noticed before, occurring as they do in a form that has received so much attention, from an anatomical point of view, as Orcynus. Then, too, taking into consideration the morphological significance that attaches to them, one would look for at least a mention of such a condition in the text-books of Owen, Huxley, Gegenbaur, Parker, or others; but such I have failed to find, and the embryologists seem also to have overlooked them. Sir Richard Owen would certainly have had occasion to mention such a pair of ribs in his method of treating the osteology of the piscine skull. R. W. SHUFELDT.

Washington, June 2.

JEAN-BAPTISTE-ANDRÉ DUMAS.

JEAN-BAPTISTE-ANDRÉ DUMAS was born at Alais, in the south of France, July 14, 1800. He was educated at the college of his native place, and appears to have been destined by his parents for the naval service; but his parents abandoned their plan, and apprenticed him to an apothecary of the town. He remained in this situation, however, but a short time. In 1816 he travelled on foot to Geneva, where he found employment in the pharmacy of Le Royer.

At that time Geneva was the centre of much scientific activity; and young Dumas had the opportunity of attending lectures on botany by de Candolle, on physics by Pictet, and on chemistry by Gaspard de la Rive.

About this time, young Dumas had the good fortune to render an important service to Dr. Coïndet, to whom it had occurred that burnt sponge, then generally used as a remedy for goitre, might owe its efficacy to the presence of a small amount of iodine. Dumas not only proved the presence of iodine in the sponge, but also indicated the best method of administering what proved to be almost a specific remedy. It was in connection with this investigation that Dumas's name first appears in public, as the discovery produced a great sensation.

Soon after, Dumas formed an intimacy with Dr. J. L. Prévost, then recently returned from pursuing his studies in Edinburgh and Dublin, and was induced to undertake a series of physiological investigations, which for a time withdrew him from his strictly chemical studies. Several valuable papers on physiological subjects were published by Prévost and Dumas, which attracted the notice of Alexander von Humboldt, who, on visiting Geneva in 1822, sought out Dumas, and awakened in him a desire to seek a wider field of activity. In consequence he removed to Paris in 1823, where the reputation he had so deservedly earned at Geneva won for him a cordial reception.

In 1826 he married Mlle. Herminie Brongniart, the eldest daughter of Alexandre Brongniart, the illustrious geologist; and in after years his house became one of the chief resorts of the scientific society of Paris.

In 1828–29 Dumas united with Théodore Olivier and Eugène Péclet in founding the École centrale des arts et manufactures. In 1832 Dumas succeeded Gay-Lussac as professor at the Sorbonne; in 1835 he succeeded Thenard at the École polytechnique; and in 1839 he succeeded Deyeux at the École de médecine. Thus, before the age of forty, he filled successively, and for some time simultaneously, all the important professorships of chemistry in Paris except that of the College of France, with which he was never permanently connected.

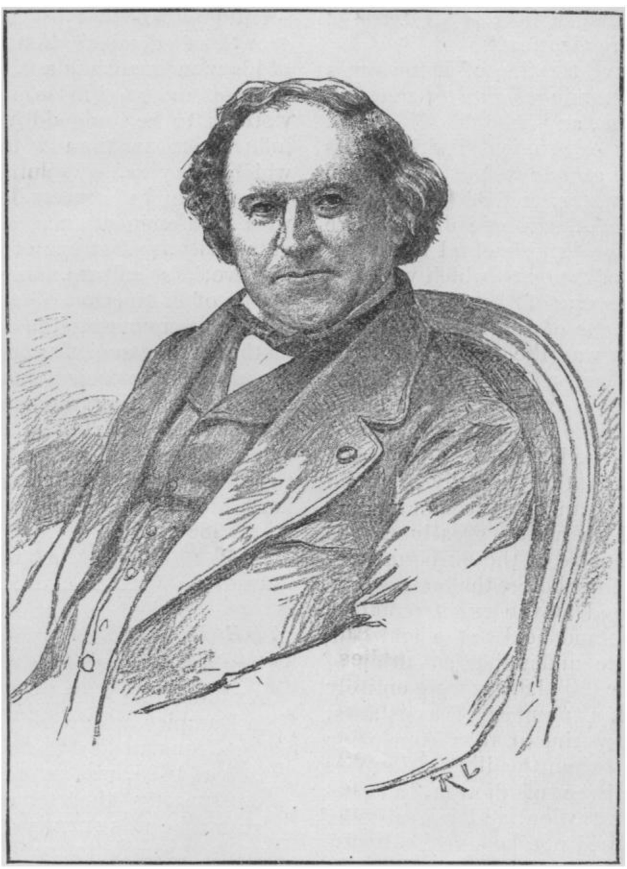
Dumas early recognized the importance of laboratory instruction in chemistry, for which there were no facilities at Paris when he first came there, and in 1832 founded a laboratory for research at his own expense.

The political and social upheaval of 1848 seemed at the time to endanger the stability in France of every thing which a cultivated and learned man holds most dear; and Dumas was not one to consider his own preferences, when he felt he could aid in averting the calamities which threatened his country. Immediately after the revolution of February, he accepted a seat in the legislative assembly. Shortly afterwards the president of the republic called him to fill the office of minister of agriculture and commerce. During the second empire he was elevated to the rank of senator, and shortly after his entrance into the senate he became vice-president of the high council of education. In order to reform the abuses into which many of the higher educational institutions of Paris had fallen, he accepted a place in the municipal council of Paris, over which he subsequently presided from 1859 to 1870.

In 1868 Dumas was appointed master of the mint of France; but with the fall of the second empire, in 1870, his political career came to an abrupt termination. Some years previously he had resigned his professorships; and now, at the age of seventy, he found himself for the first time free to devote his leisure to the noble work of encouraging research, and thus promoting the advancement of science. He had reached an age when active investigation was almost an impossibility, but his commanding position gave him the opportunity of exerting a most powerful influence; and this he used with great effect. In early life he had been elected, in 1832, a member of the Academy of sciences; in 1868 he had succeeded Flourens as its permanent secretary; and in 1875 he was elected a member of the French academy as successor to Guizot, — a distinction rarely attained by a man of science. It was, however, as permanent secretary of the Academy of sciences that Dumas exerted, during the last years of his life, his greatest influence.

When the writer last saw Dumas, in the winter of 1881–82, the great chemist had still all the vivacity of youth, and it was difficult to realize his age. He took a lively interest

in all questions of chemical philosophy, which he discussed with great earnestness and warmth. There were the same fire and the same exuberance of fancy which had enchanted me in his lectures thirty years before. At an age when most men hold speculation in small esteem, I was much struck with his criticism of a contemporary, who, he said, had no imagination, although he spoke with the highest praise of his experimental skill. At that time Dumas showed no signs of impaired strength; but during the following year his health began to fail, and he died on the 11th of April, at Cannes, where he had sought a retreat from the severity of the winter climate of Paris.



Dumas was not only eminent as an investigator of nature, but even more eminent as a teacher and an administrator. Without attempting to detail Dumas's numerous contributions to chemical knowledge, we will here only refer to three important investigations, which produced a marked influence in the progress of chemical science.

After his removal to Paris he took up the problem which the relations of the molecular volumes of aeriform substances present; and his paper on some points of the atomic theory had an important influence in developing our modern chemical philosophy. We are surprised that Dumas did not at once realize the consequences which the doctrine of equal molecular volumes involves in the interpretation of the constitution of chemical compounds, and the clear distinction between 'the physically smallest particles' and 'the chemically smallest particles,' or the molecules and the atoms, as we now call the physical and the chemical units. But more than a quarter of a century passed before the full harvest of this fruitful hypothesis could be reaped.

But if this investigation of gas and vapor densities brought a great strain upon the dualistic system, the second of the three great investigations of Dumas, to which we have referred, led to its complete overthrow. The most important of the experimental results were the substitution products obtained by the action of chlorine gas on acetic acid; and the capital point made, was that chlorine could be substituted in acetic acid for a large part of the hydrogen without destroying the acid relations of the product; and the inference was, that the qualities of a compound substance depend, not simply on the nature of the elements of which it consists, but also on the manner or type according to which these elements are combined.

To the chemists of the present day these results and inferences seem so natural that it is difficult to understand the spirit with which they were received forty years ago. But it must be remembered that at that time the conceptions of chemists were wholly moulded in the dualistic system. It was thought that chemical action depended upon the antagonism between metals and metalloids, bases and acids, acid salts and basic salts, and that the qualities of the products resulted from the blending of such opposite virtues. That chlorine should unite with hydrogen was natural, for no two

substances could be more unlike; but that chlorine should supply the place of hydrogen in a chemical compound was a conception which the dualists scouted as absurd.

By the second investigation, as by the first, although Dumas gave a most fruitful conception to chemistry, he only took the first step in developing it. His conception of chemical types was very indefinite; and Laurent wrote of it a few years later, "Dumas's theory is too general; by its poetic coloring, it lends itself to false interpretations; it is a programme of which we await the realization."

The third great investigation of Dumas was his revision of the atomic weights of many of the chemical elements, and in none of his work did he show greater experimental skill. His determination of the atomic weight of oxygen by the synthesis of water, and of that of carbon by the synthesis of carbonic dioxide, are models of quantitative experimental work.

That exuberance of fancy to which we have referred made Dumas one of the most successful of teachers, and one of the most fascinating of lecturers. It was the privilege of the writer to attend the larger part of two of his courses of lectures given in Paris in the winters of 1848 and 1851, and he remembers distinctly the impression produced. Besides the well-arranged material and the carefully prepared experiment, there was an elegance and pomp of circumstance which added greatly to the effect. The large theatre of the Sorbonne was filled to overflowing long before the hour. The lecturer always entered at the exact moment, in full evening dress, and held to the end of a two-hours' lecture the unflagging attention of his audience. The manipulations were entirely left to the care of a number of assistants, who brought each experiment to a conclusion at the exact moment when the illustration was required. An elegance of diction, an appropriateness of illustration, and a beauty of exposition, which could not be excelled, were displayed throughout; and the enthusiasm of a French audience added to the animation of the scene.

To the writer, the lectures of Dumas were brought in contrast to those of Faraday. Both were perfect of their kind, but very different. Faraday's method was far more simple and natural, and he excelled Dumas in bringing home to young minds abstruse truths by the logic of well-arranged consecutive experiment. With Dumas there was no attempt to popularize science: he excelled in clearness and elegance of exposition. He exhausted the subject which he treated, and was able to throw a glow of interest around details which by most teachers would have been made dry and profitless.

In the early part of his life, Dumas was a voluminous writer, and in 1828 published the 'Traité de chimie appliquée aux arts' in eight large octavo volumes, with an atlas of plates in quarto. But, besides this extended treatise, two volumes of lectures are his only important literary works. He published numerous papers in scientific journals, which, as we have seen, produced a most marked effect on the growth of chemical science. But the number of his monographs is not large, compared with those of many of his contemporaries; and his work is to be judged by its importance and influence rather than by the extent of the field which it covers.

It was to be expected that a man working with such eminent success in so many spheres of activity, and at one of the chief centres of the world's culture, should be loaded with marks of distinction of every kind. It would be idle to enumerate the orders of knighthood or the learned societies to which he belonged; for, so far from their honoring him, he honored them in accepting their membership. It is a pleasure, however, to remember that he lived to realize his highest ambitions, and to enjoy the fruits of his well-earned renown. France has added his name in the Pantheon

'Aux grands hommes la patrie reconnaissante.'

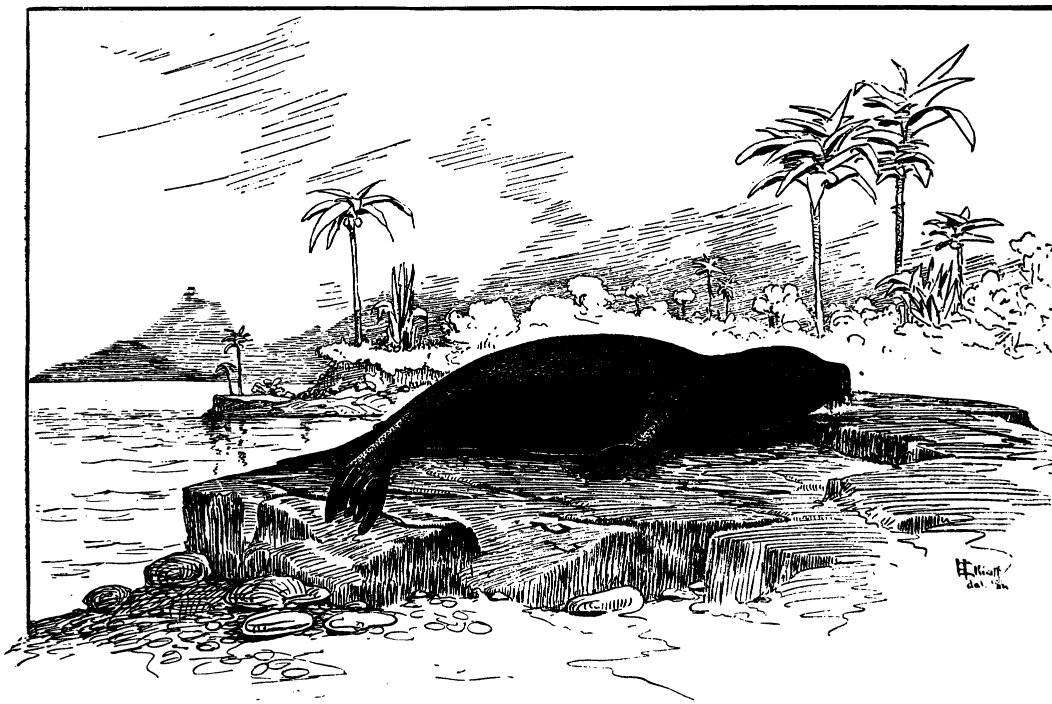
THE MONK-SEAL OF THE WEST INDIES, MONACHUS TROPICALIS GRAY.

An old English navigator and privateer, William Dampier, while straining his eyes for Spanish galleons in the Caribbean Sea during the season of 1675, was astonished at finding many seals sunning themselves on the Alacrane Islands: he was surprised, for he did not look for these animals in tropical waters, and hence he made voluminous notes of them.[1] To this memorandum we are obliged to turn for all the knowledge that we have to-day of the rare form of which we offer the accompanying drawing. The specimen from which it was taken is now believed to be the only one in existence; for the one which was in the British museum, collected in 1843 by Gosse and Hill, has been destroyed. The one which we figure is now in the new National museum at Washington: it was recently taken on the coast of Cuba, bought of some Cubans by Professor Felipé

[1] Dampier, Voyage round the world, ii. 2, 3d ed., 1705, p. 23.

Poey of Havana, and by him presented to the Smithsonian institution.

The color of the body of this tropical seal is an intense ebony black, with the hair remarkably short and stiff. The length of this creature is about four feet, with a circumference of the body near the fore-arms of three feet. Although Dampier seems to have been impressed by the large numbers of these seals in 1675, yet, as long ago as 1843, it was excessively rare, — as much so as it is to-day. This fact declares the industry and zeal of the old 'oyle' hunters, who were busy in slaughtering the Monachus long after Dampier set the example.



In the *Jamaica almanack* for 1843, Mr. Richard Hill published a memoir on a seal inhabiting the Pedro Kays, a reef of rocks lying off the south coast of Jamaica. This has been transcribed by Allen, and it seems to apply directly to the animal which we figure. Allen sums its distribution up as follows: "It therefore appears that the habitat of the West-Indian seal extends from the northern coast of Yucatan, northward to the southern point of Florida, eastward to the Bahamas and Jamaica, and southward along the Central-American coast to about latitude 12°. Although known to have been once abundant at some of these localities, it appears to have now well-nigh reached extinction, and is doubtless to be found at only a few of the least frequented inlets in various portions of the area above indicated." Being still well known to many of the wreckers and turtle-hunters, it seems strange that it should have remained almost unknown to naturalists.

Perhaps this figure and notice may serve to stimulate the attention of some one of the many fruit and sponge vessel owners now cruising in West-Indian waters, who, detecting the presence of another specimen, may secure it, and forward the rare and valuable trophy to those who would appreciate and preserve it.

HENRY W. ELLIOTT.

Smithsonian institution, May 21.

THE TOEPLER-HOLTZ MACHINE.

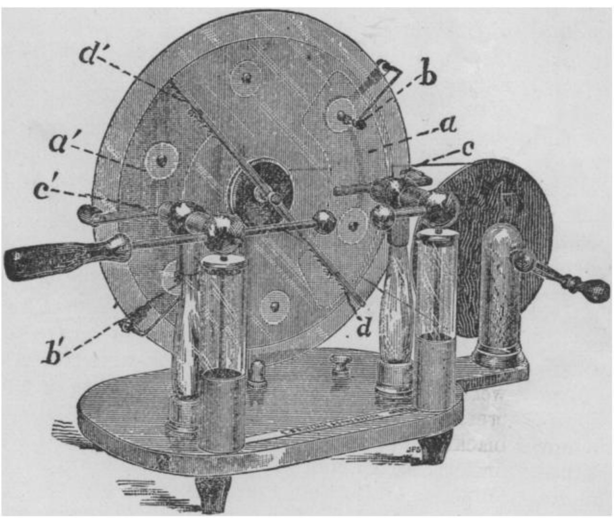
THE Toepler-Holtz induction electric machine is too well known to need description; but, as no explanation of its action is to be found in any book which has come under my observation, the following explanation may be of interest to teachers: —

Consider the machine before you, the revolving-plate in front.

Designate the right-hand paper sector by a, the brush connected with it by b, the comb connected with the discharging-rod by c, the comb in metallic connection with a similar comb diagonally opposite by d, and the corresponding parts on the left-hand side by a', b', c', and d'.

If the left-hand sector a' be charged with negative electricity, it draws positive electricity from the comb d' upon the revolving-plate, which is supposed to move in the direction of the hands of a watch. When the positive electricity on the plate reaches the brush b, it draws negative electricity from the brush, and leaves the sector a charged with positive.

This positive electricity on the sector, and the positive that is left on the plate, both draw negative from the comb c, and leave the discharging-rod connected with it charged with positive electricity.



The plate, now nearly neutral, passes under the diagonal comb d, and from it receives a charge of negative electricity, drawn out by the positive on the sector a, which at the same time repels positive electricity along the diagonal, and out of d' upon the revolving-plate.

The plate, now charged with negative electricity, passes under the brush b', draws positive electricity from it, and thus increases the negative charge on the sector a'. The residue of negative electricity on the plate, and the negative on the sector, both draw positive from the comb c', and leave the discharging-rod connected with it charged with negative electricity. The plate, now nearly neutral, passes to our starting-point d', and the process is repeated.

If the machine is operated in the dark, the brush b', and the points on c' and d', will be tipped with the well-known positive brushes, while b, c, and d will show only the negative glowing points. The relative lengths of the brushes on c' and d' will depend on the position of the discharging-rods. If a is negative in the place of a', the position of the brushes will, of course, be reversed. The nature of the electricity on any part of the machine may be tested by bringing the point of a lead-pencil near it, and noticing the form of the discharge from the point.

The great use of the knobs on the revolving-plate is to keep the paper sectors charged. Two knobs give better results than the usual six or eight; the reason apparently being, that the larger number of knobs keeps the sectors overcharged, and there is a continual loss (by brushes from the sectors) of electricity that would otherwise remain on the revolving-plate, and help to increase the charge on the discharging-rods.

Somewhat longer sparks are also obtained by connecting the sectors and discharging-rods on the same side by conductors; but the machine, thus arranged, reverses more readily, does not give sparks so rapidly when the discharging-knobs are near together, and is started by separating the knobs.

In some forms of the machine used in Germany the fixed plate is in two parts, separated by a vertical air-space. This is an improvement, because it prevents the electricities of the two sectors from uniting across the surface of the plate. Machines of this sort sometimes have as many as sixty revolving-plates, all on one axis. Such machines give large quantities of electricity, but not very long sparks.

The following experiments, not generally known, illustrate the power of the single plate machine. If a strip of vulcanite about two inches wide is moved to and fro in front of the positive pole, the length of the spark will be greatly increased, sometimes reaching five inches and a half on a machine whose revolving-plate is only ten inches and a half in diameter. If a drop of stearine is placed on a thin sheet of glass, which is too large for the spark to pass around the edges, and the glass is held between the discharging-knobs of a good ten-and-a-half-inch machine, with the drop toward the positive knob, the spark will

pierce the glass when the knobs are about one inch apart. H. W. EATON.

GEOLOGY AND MINERALOGY OF NORTHERN CANADA.[1]

By northern Canada, the author meant the whole of the Dominion northward of the organized provinces and districts, as far as known. His information was derived from his own observations around Hudson's Bay and in the North-west territories, and from the reports and maps of the scientific men who had accompanied the various arctic expeditions by land and sea. Specimens and interesting notes on the geology of Great Slave Lake had been received from Capt. H. P. Dawson, R.A., who had spent last year there, in charge of the Canadian station of the circumpolar commission. The distribution of the various formations, from the oldest to the newest, was illustrated by a large, geologically colored map of the whole Dominion. Referring to the Laurentian system, Professor Bell showed that it forms the surface-rock over an enormous circular area on the main continent, and that the central part of it is occupied by Hudson's Bay, with a border of paleozoic rocks around it. Laurentian rocks are largely developed in Greenland, and along the Atlantic coast from Newfoundland to Georgia. Taken together, the general outline of the Laurentian areas of North America has a form corresponding with that of the whole continent, which has been built around these ancient rocks. The Huronian strata which constitute the principal metalliferous series in Canada were closely associated with the Laurentian, and appeared to be always conformable with them. The largest and best-known areas were between Lake Huron and James's Bay; but Dr. Bell had found four belts of them on the east coast of Hudson's Bay, and others had been recognized in the primitive region to the west of it. Indeed, wherever the older crystalline rocks had been explored in Canada, belts or basins having the character of the Huronian series had been met with. Limestones, slates, and quartzites, interstratified with amygdaloids, basalts, etc., corresponding with the Nipigon formation of Lakes Superior and Nipigon, were largely developed on the Eastmain coast and adjacent islands of Hudson's Bay, and apparently, also, on the Coppermine River, and to the westward of it. But a set of hard red siliceous conglomerates and sandstones were seen to come between the Huronian and the Nipigon series at Richmond Gulf on the Eastmain coast, which appeared to be unconformable to both. Mr. Cochrane and Dr. Bell had found similar rocks on Athabasca Lake; Capt. Dawson, on Great Slave Lake; and Sir John Richardson, to the north-east of Great Bear Lake. The conglomerates, slates, and gray argillaceous quartzites of Churchill, and the white fine-grained quartzite of Marble Island, were probably of this horizon. Silurian rocks were well known to be widely spread on some of the largest of the arctic islands, and along the most northern channels of the Polar Sea. They formed an irregular and interrupted border on the western sides of Hudson's and James's Bays. A large basin of Devonian strata containing gypsum and clay-ironstone extended south-westward from James's Bay. West of the great Laurentian area, Devonian rocks could be traced here and there, all the way from Minnesota to the mouth of the Mackenzie River. They were not, however, so widely distributed as had been supposed by the older travellers who had passed rapidly through the country in the early part of the century, when the whole subject of American geology was in its infancy. The so-called bituminous shales of Sir John Richardson and others, which are so prevalent along the Athabasca and Mackenzie Rivers, were found by Professor Bell to consist of soft cretaceous strata, which had been saturated and blackened by the petroleum rising out of the underlying Devonian rocks, which here, as in Ontario, Ohio, and Pennsylvania, are rich in this substance. The principal features and the geographical distribution of the carboniferous, liassic, cretaceous, and tertiary rocks of the northern regions were successively described. Among other points of interest in reference to the post-tertiary period, Dr. Bell mentioned that the remains of both the mastodon and the mammoth had been found on Hudson's Bay, and that elephants' tusks were reported to occur on an island in its northern part. Isolated discoveries of elephantine remains had been made in the North-west territories, and several on the Rat River, a tributary of the Yukon, near the borders of Alaska.

In referring to the economic minerals, Professor Bell said that even the coarser ones, such as granite, limestone, cement-stone, slate, flagstone, gypsum, clays, marls, ochres, sand for glass-making, etc., would yet have their value in different parts of the great region

[1] Abstract of a paper on the geology and economic minerals of Hudson's Bay and northern Canada, read to the Royal society of Canada, May 23, by Dr. ROBERT BELL.

under consideration. Soapstone, mica, plumbago, asbestos, chromic iron, phosphate of lime, salt, pyrites, etc., had been noted in different localities. Among ornamental stones known to occur, might be mentioned the rare and beautiful mineral lazulite; also malachite, jade, agate, carnelian, chrysoprase, and others. Extensive beds of lignite were found in many places in the great tract of country occupied by the cretaceous and tertiary rocks in the Athabasca-Mackenzie valley and on the coasts and islands of the Arctic Sea; also in tertiary strata at Cumberland Bay, and in Greenland on the opposite side of Davis Strait. On the Moose River were considerable beds of lignite of post-tertiary age. Anthracite of a very pure quality had been found on Long Island in Hudson's Bay. Petroleum rising from the Devonian strata was found through a long stretch of country in the Athabasca-Mackenzie valley. Great quantities of asphalt, resulting from this petroleum, occurred along these rivers and on Great Slave Lake, as well as in various places in the interior. Of the metallic ores, those of iron were very abundant. Inexhaustible quantities of rich manganiferous ironstone exist on the Manitonink Islands, near the east coast of Hudson's Bay. The bedded ore formed the surface over hundreds of square miles, and it was broken up by the frost into pieces of a convenient size for shipping. Valuable deposits of magnetic iron had been found on Athabasca and Knee Lakes, and a thick bed of fine clay-ironstone on the Mattagami River. Capt. Dawson, R.A., had found a vein of crystalline specular iron on Great Slave Lake. Copper ore had been discovered on Hudson's Bay; and the native metal was known to occur in quantities on the Coppermine River, in rocks like those with which it is associated on Lake Superior. Galena was abundant in limestone from Little Whale River to Richmond Gulf, on the Eastmain coast. Zinc, molybdenum, and manganese had also been found on this coast, and antimony in the north. Gold and silver had likewise been detected in veins on the east coast; and alluvial gold had been washed out of the gravel and sand of different streams in the mountainous region west of the lower part of the Mackenzie River. For various reasons, Dr. Bell regarded this region as a highly promising one for the precious metals. The belt of auriferous drift, which crosses the North Saskatchewan at Edmonton, and from which the gold-dust is there washed, may have been brought from this region by ancient glaciers from the valleys of the upper branches of the Liard and Peace Rivers. A number of years ago, Dr. Bell had originated the theory that this gold might have been derived from Huronian rocks to the north-eastward of Edmonton; but he now thought it quite as likely to have had its source in the direction of Cassiar.

THE SCIENTIFIC ACTIVITY OF THE RUSSIAN UNIVERSITIES DURING THE LAST TWENTY-FIVE YEARS.[1]

No endeavor has as yet been made to properly estimate the scientific activity of our universities during the last quarter of a century; and this, I believe, mainly accounts for the sweeping condemnations which make their appearance from time to time, to the effect that our universities are declining, and that the high tide of their scientific activity was long ago passed. Submitting to the judgment of the reader a first feeble attempt of this kind with respect to the development of natural science, including the principles of medicine, I wish expressly to state that the material at my command, while not embracing all accomplished by the universities in the direction of natural science, nevertheless includes every thing essential to point out and prove the most prominent features of the results attained. This, indeed, is the object of the present article. My review excludes the universities at Dorpat and Helsingfors, as they, by their whole constitution, always distinguished themselves from their purely Russian brethren: it also fails to take into account the scientific activity of those members of our academy who are not connected with any Russian university. The material for this sketch has been brought together, not by myself, but by specialists in their respective branches of knowledge, — in physics, by Professor Petrushèfsky; in chemistry, by Professor Menshùtkin; in botany, by Professors Bekètoff, Borodin, and Gobi; in zoölogy, by Professor Bogdànoff; in geology, by Professor Inostràntseff; in anatomy and physiology, by myself.

If we are to measure the scientific activity of an institution by the degree in which its members participate in the resolution of scientific questions, — and this seems to be the only correct standard, — then the activity of the Russian universities in natural science during the thirty years from 1830 to 1860 cannot be deemed great. Indeed, the number of university professors (with Russian names) engaged in scientific work was small; and these stood almost alone, as it were, hardly exerting any considerable influence over those around them.

There were, of course, many causes for this scarcity and isolation of working-forces; but the principal one, undoubtedly, is to be sought in the general conditions of university life. These conditions logically grew out of the view then accepted as to the object of university-work in regard to the intellectual

[1] Translated and abridged from the Russian of I. SÈCHENOFF, in the *Vestnik Evropy* (European herald) for November, 1883.

life of the country, — a view which, in our time, is no longer held. Even after the middle of this century, universities were looked upon in this country, merely as places for the dissemination of knowledge, where young people were instructed in the higher branches of science. To this end the entire activity of the universities was directed: indeed, the work of the university consisted simply in the delivery of lectures by professors, who undertook to acquaint their hearers with the last results of science, while the students were merely passive recipients. The professors were not required to do real scientific work, which at the present time alone constitutes true learning: such work was left to a select few, and it seldom emerged from the seclusion of the cabinet into close contact with the audience. It is characteristic of those times that such occupations were called the crude preparatory work. I myself have heard a learned man of that epoch (since dead) seriously call himself a 'laborer,' in contradistinction to the orator-professors.

The results obtained were such as might have been anticipated with this disposition of the public mind. Instruction by lectures was the chief aim: independent scientific work, although esteemed, was not obligatory, and was considered a matter to be left to personal predilection.

There were, of course, exceptions to this rule. Thus, for instance, the faculty of natural science at the St. Petersburg university showed some signs of organic scientific life, even during this period. This, however, was a consequence of the continuous close relations between the university and the neighboring academy, where science was practically cultivated, so to speak, by legal requirement. Some of the chairs of natural science in the university were occupied by academicians; others, by persons closely connected with the academy: for this reason we here find all the indications of a true scientific life. Besides the museums and the chemical laboratory, there were introduced into the university laboratories of some sort for other branches; some practical work in botany and zoölogy was required from the students; to a chosen few the physical laboratory of the academy of science was open; and even the old chemist Solovyòff himself superintended the practical exercises of the students. Tsenkòfsky's teacher, Shikhòfsky, with the aid of a single microscope, had to instruct his pupils in making microscopic observations; but he left behind him a pupil who has won a great reputation by his microscopic investigations.

We see, then, that, during the generation preceding our own, the whole condition of university life was any thing but favorable to the development of natural science. At that time, even Germany, whence our learning has been derived, probably had not yet fully awakened to the idea, that, to properly fulfil their purpose of disseminating knowledge, universities ought to be, not only institutions where science is rhetorically expounded, but also centres for developing and advancing scientific work. The old and simple belief that teaching, as well as learning, can be made successful only through real work, did not secure a broad, practical recognition in Germany before the sixth decade of the present century, when rich laboratories for natural science came to be considered indispensable attributes of a university. It is true that laboratories of some kind did exist in western Europe in former times; but their origin was due to local causes, accidental in character: they sprang up wherever a prominent worker in science had gathered pupils around him. The laboratories of our time have a much broader significance: as indispensable attributes of every university, they change the whole system of instruction; as institutions adapted to the practical working-out of scientific problems by many individual investigators, they superseded the closet of the student, and introduced to learners the very process of the building-up of science; as schools for practical instruction, laboratories materially raise the level of education among the masses; as working-centres where science is advanced, not by individual, but by united efforts, they materially increase the scientific productivity of the country. In Germany their importance is so fully recognized, that, even in universities of the second rank, hundreds of thousands of roubles are expended on the construction of laboratories in connection with the various chairs.

Hence it will readily be perceived what an immense service was rendered Russian science by the reform of our universities in the seventh decade of our century, when laboratories were established in connection with the faculties of medicine and of natural science, and provided with the necessary means, the staff of instructors being correspondingly increased. Another beneficent measure was the greater facility afforded private persons of leaving the country to study abroad, and the increased frequency with which the government sent young people abroad for the same purpose. This last measure, though long before in vogue by the universities for preparing their professors, at that time became even more necessary; for while, between 1848 and 1856, the ordering of students abroad had entirely ceased, by the new regulations the number of instructors was enlarged. I shall hardly err if I say that about one-half of the present professors in the faculties of medicine and of natural science have come from those young men who went abroad between 1856 and 1865.

The increase in the number of workers in natural science during the period under discussion appears most clearly from the formation of societies of naturalists at the universities. In the preceding period there were but two such societies in existence in Russia, — the mineralogical society at St. Petersburg, and the Moscow society of naturalists. At present there are, at the universities, seven societies of naturalists. Besides these, we have the Russian entomological society, and the societies at Yaroslàvl, Ekaterinbùrg, Tashkènt, and Tiflìs.

General confirmation of this opinion, respecting the increase in the number of workers in natural science, is found in our periodical congresses of naturalists. After the first congress, societies of naturalists organized at the universities; and the geological, zoölogi-

cal, and botanical sections of these societies began to send parties of investigators annually (usually for the summer) to all parts of Russia. Making the best of their limited means, they allowed a maximum of four hundred or five hundred roubles a person.[1]

At the instance of the same societies, larger expeditions, subsidized by the government, were sent out into Turkestàn (Fedchènko), into Khiva (Bogdànoff), into the Aralo-Caspian territory (Bogdànoff, Barbotte, Grimm, and Alenìtsyn), to the Murmàn coast (Bogdànoff, with seven students), to the White Sea (Tsenkòfsky and Wagner), among the Altai (Nikòlsky, Sokolòff, Polènoff, and Krasnòff).

Russian names occur in the foreign literature of natural science, even during the preceding period, though they are very rare, and not often important. But about 1860, that is, when Russian students began to throng to foreign universities (chiefly German), a rapid increase is perceptible in the number of Russian names appearing as contributors to foreign journals; and this number is steadily maintained at a figure previously unheard of. Even if the productions of these first years were often of an elementary character, they are nevertheless important as presenting a striking proof of a fact hitherto unprecedented in Russia; viz., that, in the very beginning of the period under discussion, a considerable number of young Russians passed through a very thorough course of study. The importance of this fact is enhanced when we recollect that our young laboratories drew their first supply of workers from those who, during this time, studied abroad.

Everybody who has ever been at the head of a newly established laboratory, will, I think, agree that it requires years, even in the case of an experienced director, to prepare two or three students for independent research. Now, in our case, in the seventh decade of the present century, the difficulty was enhanced by the fact that the management of laboratories was still a novelty, and the students were ill prepared. It is therefore not to be wondered at, that individual scientific activity only clearly manifested itself in our laboratories long after their foundation. This scientific activity, however, now exists in almost all laboratories of our country; and it shows itself in this, — that the working-out of scientific problems is not restricted to the professors alone, who may, perhaps, be said to derive their learning from western Europe. The students of the local Russian laboratories, also, now take part in this work. In former times it was impossible, with rare exceptions, for a Russian to become an independent scientific worker without going abroad to study: at present he can receive and complete his education at home.

It may not be amiss to present, in illustration of this change, some particularly striking figures.

Between 1830 and 1860, I do not recall a single special investigation in the branches of microscopic anatomy, physiology, and experimental pathology, made by a university professor of pure Russian name. During the present period, i.e., in the course of the twenty years from 1863 to 1882 inclusive, more than six hundred and fifty investigations in these branches, by authors of pure Russian name, were published in foreign periodicals. From this number are excluded all Dorpat professors, and foreigners like Professor Gruber; also, probably, a number of Russians by birth and education, but bearing foreign names.

The most remarkable showing, however, is made by our chemists. During the fourteen years from 1869 to 1882 inclusive, the journal of the Russian physico-chemical society published six hundred and seventy investigations, not including those relating to applications of chemistry to pharmacy, technology, and medicine.

Chemistry, having from the very outset of this period engaged the attention of such eminent workers as Zìnin, Bùtleroff, Mendelèyeff, N. Bekètoff, N. N. Sokolòff, and others, enjoyed a more rapid development than all other branches of natural science. For a long time it occupied among the sciences the first place; and this place it has succeeded in retaining. Just after the first congress of naturalists was held in 1867, the chemical (now physico-chemical) society was founded, with a journal for the publication of scientific researches; and this journal became the organ of Russian chemists. The investigations are thus first published in the Russian language; but the German, London, and Paris chemical societies regularly receive an account of them through special corresponding members, and they are also reported to the Italian chemical gazette. How completely the work of Russian chemists is recognized in western Europe, will appear from the statement of an eminent English man of science: Frankland said, that in chemistry there are more independent investigations published in Russia than in England. Our chemists, however, take the lead not by quantity alone: there are branches of chemistry in which they appear among the best specialists; and yet the principal representatives of Russian chemistry are engaged in researches extending over the entire domain of chemical knowledge.

The development of physics, from the very nature of things, could not keep pace with this rapid progress, especially as there were hardly any well-trained scientific men at work in this branch at the beginning of our period. At present, physics numbers, among its independent leading workers, Petrushèfsky, Lenz, Stolètoff, Avenarius, Shvèdoff, and others.

The scientific activity of our botanists proved exceedingly fertile. At the beginning of our period, Tsenkòfsky stands out eminent indeed, but alone: in the course of twenty-five years, his intellectual offspring has become a family of seventy-five workers; and of this number we may certainly assume that three-quarters grew up in the Russian school. During the preceding period, Russian botanists were almost exclusively engaged in the study of local floras: at present, the study of botany has been specialized into the branches of anatomy, physiology, development of plants, and botanical geography. In

[1] Each of these societies has a government subsidy of twenty-five hundred roubles (about fifteen hundred dollars), apart from the contributions of the members, the physico-chemical society alone receiving no subsidy.

anatomy, eighty-seven original researches appeared during this period; in physiology, a hundred and fifty-two. The number of special investigations in botanical geography during the last twenty years amounts to twenty, while the articles relating to local floras number about a hundred.

During this period, zoölogy developed in two directions: on the one hand, investigations of faunas, increasing considerably in quantity and quality, form a continuation of the preceding period; and, on the other hand, a new phase of zoölogical research is inaugurated by workers in the field of comparative anatomy, of animal histology, and of embryology. At the head of this last movement, fortunately, we find such exceedingly talented men and energetic workers as Kovalèfsky and Mèchnikoff, who enjoy in Europe a reputation not less honorable than that of the principal representatives of our chemical school. This is the reason why the new movement not only soon extended over Russia generally, but gained a strong foothold; so that at present it has representatives in every university, and unites the body of common workers into a Russian zoölogical school.

A review of the development of mineralogy and geology in the universities during the last twenty-five years is embarrassed with two difficulties. In three of the six universities to which this article refers, the scientific workers of the previous epoch continue their activity into the present period. On the other hand, the mining-engineers, *pari passu* with the university-workers, begin to work zealously, and their common labors appear in the same publications. An over-nice discrimination of the work of the mining-engineers from the work done by the universities, will, however, be superfluous, when we reflect that the stimulation of scientific activity among the mining-engineers is primarily due to the same causes that infused new life into the universities themselves. These causes were the reforms in the mining-corps (now become a mining-institution) which were in the same direction as the new system of instruction in the natural science faculties. The increased activity among the mining-engineers, being a product of the same cause, merely fortifies by additional proof the leading idea of this article. From this point of view, the activity in mineralogy and geology will appear to have increased very considerably. Since 1869 the St. Petersburg mineralogical society has published thirteen volumes of 'Materials for the geology of Russia' (in Russian). In the St. Petersburg society of naturalists alone, there were received two hundred and ten original communications from 1868 to 1882 inclusive; and, in the 'Index to Russian literature in mathematics and pure and applied science' (in Russian), we find enumerated two hundred and seventy-four works (pamphlets and books) on mineralogy and geology for the period 1873 to 1879. In addition, it should be mentioned that our present university geologists, by practical work, have transplanted to Russian soil the problem of prehistoric man, and the application of microscopy to the investigation of mineral species.

Finally, as above mentioned, the sciences of microscopic anatomy and physiology began to be cultivated in Russia between 1860 and 1870. The first to introduce them were the Dorpat professors, the late Yakubòvich and Ovsiànnikoff. They were followed by a succession of Russian specialists who had studied abroad between 1855 and 1865. The following data will show to what extent these young sciences took root and thrived in Russia. When in Germany, between 1870 and 1880, the composition of histological and physiological text-books was undertaken by collaboration, our scientific men, being recognized as specialists, were asked to write certain parts of these works. Some of them complied with this request; as, for instance, Babùkhin and the late Ivànoff. There are even names to which the honor belongs of having established new and important methods of research: to Khronshchèfsky, for instance, is due the method of transfusion. At the present day, there is hardly a branch of these two sciences that has not been more or less successfully attacked by Russian investigators; and a large proportion of their work has been done at home.

Such is a general outline of the results obtained by our universities in natural science, thanks to the reforms introduced in the seventh decade of our century. In reality they are even greater than here represented, since the data at my disposition do not include every thing actually accomplished. Is not this ample evidence that the naturalists of our universities have commendably improved their opportunity, and honorably fulfilled the task imposed on them? Not to speak of the industrial and other material advantages always following the development of natural science in a country, the mere fact that this development exists is of great importance from an intellectual point of view, especially for novices in civilization, like ourselves.

The appearance of science always marks the culminating-point in intellectual development: it is always and everywhere the surest touchstone of the capacity of a race for the highest culture. When a race has successfully undergone this test, it at once takes its place among civilized nations. When recently we mourned Turgièneff, it was justly pointed out as one of his merits, that his work had fostered the intellectual commerce of Russians with the west. Did not our naturalists do the same?

It must, however, be confessed, that, in spite of all this, we are still novices in science, and our young plantations require assiduous care. The experience of twenty-five years has demonstrated that the conditions favorable to development are to be sought in the establishment of laboratories, and in the increase of the staff of instructors. These conditions of progress, therefore, must be extended in the future, as is done in western Europe, or they must at least be maintained.

RECENT LINGUISTIC RESEARCHES.

'TOPONOMASTICS,' or the analysis of geographic names, is a branch of linguistics, which, on account of the large material and numerous publications accu-

mulating on the subject, should be considered a science by itself. Attempts to explain certain topographic appellations are found in some of the earliest writings of antiquity. Linguists and historians of prominence have always paid peculiar attention to this field of research, for no object has been named by early man without causes. Professor Egli of Zürich, who previously composed a voluminous book in furtherance of these studies (Nomina geographica, Leipzig, 1880), has just presented us with a bibliographic history of local onomatology.[1] Egli mentions over four hundred authors who have written, either exclusively or incidentally, on this instructive branch of knowledge, and subdivides their writings into four periods. The first of these extends from the earliest centuries down to 1815; the second, from 1815 to 1840; the third, from 1840 to 1860; and the last one, from 1860 to 1870. In the researches made upon American Indian locality-names, no author is more prominent than J. H. Trumbull. In another article, Egli has discussed the co-operation of Swiss scientific men in furthering local onomatology (1884).

An inquiry into the historic tribe of the Susquehannocks and the origin of the name Susquehanna has been published by Abraham L. Guss in the *Historical register* of Harrisburg, Penn. (and also issued separately), under the title 'Early Indian history on the Susquehanna.' The Virginia map of Capt. John Smith of 1606 is added to the treatise, and is of the highest importance for the early topography of these countries. The author, after a careful examination of the passages which refer to the early settlements on Susquehanna River, takes the ground, that the tribe in question was of the Iroquois stock, but that the name of the river is Algonkin, and has to be rendered by 'brook-stream,' or 'spring-water stream.'

A publication of no little interest, since it refers to an almost unknown language, is that of the Chipewayan-Tinné legend of the serpent-woman, by Emile F. S. Petitot. It is given in the original Chipewayan, with a French translation, by the Paris periodical *Melusine* (vol. ii. no. i., 1884, col. 19–21). The same interesting number also contains all the names of the rainbow of which the author could obtain any knowledge, together with explanations and myths referring to this phenomenon of nature.

Mr. John Menaul, teacher at the Laguna Pueblo of New Mexico, which speaks a Kéra dialect, is busy printing a Laguna-English catechism on his missionary press. Mrs. A. E. W. Robertson has just published her translation of the two epistles of St. Paul to the Corinthians into Creek, or Maskoki, through the American Bible society of New York (1883). Prior to this, she had translated almost the whole New Testament, with the help of instructed natives.

Ten articles previously made public by the Americanist, Count Hyacinth de Charencey, have been gathered by him in a reprint entitled 'Mélanges de philologie et de paléographie américaines' (Paris, *Leroux*, 1883. 195 p. 8°). They all refer to Mexican and Central-American languages, or to the decipherment of the calculiform Maya characters, the signification of which is still a riddle. The more noteworthy of the purely linguistic articles are those on the Sonorian group (called by him, curiously enough, the Chichimec family); on the Chiapanec, Tzotzil, Tzendal, and Cakgi; on the phonetic laws observed in the Maya family, which is called by him Mam-Huaxtec family in this article, but afterwards Maya-Quiché. Count de Charencey is one of the most active living investigators of the Indian languages, and deserves great credit for the ingenious manner by which he is prompting his countrymen to pursue these studies. But the whole attention of Europe being now directed towards the new discoveries in Africa and in parts of Asia, it seems that the time has not come yet for a general revival of Americanistic studies in Europe.

The study of jargons, or mixed languages, is a specialty to which Professor Hugo Schuchardt, the Romanist, has been devoting himself for many years. His results are published from time to time in the Proceedings of the philosophic-historic section of the Vienna academy of sciences. Three of the latest are on the Malayo-Spanish jargon of the Philippine Islands, on the English of Melanesia, and on the Indo-Portuguese of Mangalore. Schuchardt's series is published under the heading 'Kreolische studien,' and contains a large number of native songs, and other instructive specimens of the jargons spoken of. Translations are not always added to these pieces, because the majority of linguists can do without them.

A handy manual of Chinese grammar has recently been published in German by Georg von der Gabelentz, professor of oriental languages at Leipzig university.[1] It forms an extract, in succinct form, from the grammar published by the same sinologist two years before. The book is a safe guide through the intricacies of that monosyllabic language, in the acquisition of which, contrary to other languages, the judgment of the learner is put to greater activity than the memory. Twenty pages suffice to impart the elements of Chinese writing; and a short *aperçu* of the literary history of the country is added to the volume. To the Chinese words and quotations is added throughout a transcription into Roman characters.

A short scientific sketch of the Khasia language, spoken in the drainage-basin of the Brahmaputra River, eastern India, is given by A. de la Calle in the *Revue de linguistique* of Paris (1884, pp. 24–40). This article mainly consists of classified extracts from Abel Hovelacque's study of the same language, published three years since in the same periodical. Both show that Khasia holds a middle position between the isolating and the agglutinative languages, and that the majority of its terms are restricted to one syllable only.

The same number of this review concludes a bibliography of Basque folk-lore by Julien Vinson, its

[1] J. J. Egli. Ein beitrag zur geschichte der geographischen namenlehre. Wien, *Hölzel*, 1883. 106 p. 8°. (*Zeitschrift f. wissensch. geographie*, vol. iv.)

[1] Anfangsgründe der chinesischen grammatik mit übungsstücken. Leipzig, *Weigel*, 1883. 8 + 150 p. 8°.

editor. This periodical devotes special attention to the study of the Basque dialects, traditions, and literature.

The tribes of northern and north-western Australia, of which so little is known, have been sketched by Edward Palmer in the *Journal of the anthropological institute*, 1884, pp. 276-334. His article contains statements which evidently come from an experienced traveller. Nine tribes are described as to their physical and social characteristics, cannibalism, food, cooking and hunting, weapons, manufactures, amusements, superstitions, bora-ceremonies, funerals, etc. The chapter on *gentes*, or, as Palmer calls them, class-systems, brings together a large amount of new facts; and the seven vocabularies concluding the paper extend over more than a hundred and sixty terms. A. S. GATSCHET.

MODERN RAIL-MAKING.

THE making of steel rails consists of three distinct processes: the production of cast-iron from the ore; converting the cast-iron into steel in a Bessemer converter, and casting it into ingots; and rolling out the ingots into rails. According to the most recent practice, these operations follow each other so closely as to seem almost one.

Cast-iron is obtained from iron ore by reducing the ore in a blast-furnace with coke for fuel, and limestone as a flux to facilitate the reduction. The blast-furnace consists of an approximately cylindrical iron structure about seventy-five feet high, lined with bricks of refractory material, leaving an internal diameter of about twenty feet. A similarly lined bottom is securely fastened on, but can be removed for repairs. The top is closed by a cone-shaped cover suspended inside of the top of the furnace, which is here reduced in diameter. This cone is held in place by a lever and counter-weight. Air is supplied under pressure by blowing-engines, which are simply large air-compressing pumps, through openings, or tuyères, near the bottom of the furnace. The hot gases of combustion escape through openings near the top of the furnace, and are conducted away by pipes and underground conduits,—part to heat the boilers, which supply steam to the blowing-engines; and part to 'stoves,' to heat the air-blast on its way from the engines to the furnace. These stoves consist of a number of up-and-down passages built in fire-brick. Gas from the furnace is burned in one of them until it is highly heated; then the gas is turned into a cool stove, and the air-blast forced through the hot one.

The iron ore, as received from the mines, is stored in a large yard, each kind of ore occupying a specified place. The coke is stored in a large and high shed, into which it is unloaded from cars run in on overhead railroad-tracks. Supposing the blast-furnace to be in operation, the ore, limestone, and coke are loaded in hand-carts, as required; hoisted on an elevator to the charging-floor, which is on a level with the top of the furnace; and dumped upon the cone cover before mentioned. When the requisite number of loads of each kind of material is deposited on it, the cone is lowered for an instant, and the charge slides over its edge into the furnace. The ore is reduced, forming iron, which sinks by its weight to the bottom of the furnace, and a glassy slag containing most of the impurities, which floats on the top of the iron. The molten iron is drawn off through an opening at the bottom of the furnace, and, flowing through a channel in the sand floor, runs into a cup-shaped ladle holding between five and ten tons. This ladle is mounted on a narrow-gauge car on a track which leads to the converter. This completes the first stage of the process. If the iron drawn from the blast-furnace were run into channels on a sand floor, and allowed to cool, it would be the ordinary form of cast-iron known as pig-iron.

The converter, which is the essential feature of the Bessemer process of making steel, consists of a cylindrical iron casing, on which is placed a tapering portion, connecting it to a nozzle of smaller diameter. This nozzle is inclined at an angle of about forty-five degrees to the cylindrical part. The whole casing encloses a thick lining of highly refractory material. The bottom is double, the upper part being made of material like the lining, and pierced with numerous small holes, through which the air is forced in. The converter is supported on two hollow trunnions, through which the blast is supplied, and led by pipes to the double bottom. We will suppose that the converter has been heated, and is ready for a charge. The ladle of molten iron from the blast-furnace is drawn by a locomotive on an elevated track to a point a few feet above and in line with the converter. The latter is turned on its trunnions until the iron is readily poured into it from the ladle, through the nozzle or mouth. The blast of air is turned on at a pressure increasing to twenty-five pounds per square inch, and the converter turned upright. Rapid combustion takes place, the principal impurities in the iron are first attacked and burned out, the free or uncombined carbon burns next, then the combined carbon begins to leave the iron, and shortly a nearly pure iron is left in the converter. It is now turned as before, and the blast stopped: if continued, the iron itself would be oxidized. This portion of the process usually occupies about ten minutes, although some ores do not require over six, and twenty may be necessary with others.

In the mean time, an iron rich in carbon and manganese, called spiegeleisen, has been melted in a cupola resembling the blast-furnace. A definite quantity, determined by experience and analysis, has been run into a car-ladle; and, as the converter is turned at the end of the 'blow,' this car is drawn out on the track before mentioned, and the spiegeleisen poured into the converter. This is to replace, to a certain extent, the carbon burned out during the blow; the quantity being exactly determined by the quality of steel required, according to the general principle that the more carbon added, the harder is the product. The converter is now turned down; and the molten steel, which may be as much as ten tons, is poured from the nozzle into a ladle. This ladle is mounted on a hydraulic crane which stands

in the centre of a pit about five feet deep, called the ingot-pit. Around the circumference of this pit are arranged the cast-iron ingot-moulds, and the steel is drawn off from the ladle into them. A sample from each charge is tested by bending, punching, etc., and by analysis; so that an exact record is kept of each ten tons of steel. After a short interval, the ingot-moulds are lifted off: the ingots, which are approximately four feet long and twelve inches square, are taken from the pit, and loaded on cars, to be taken to the rail-mill. Thus far the methods are almost identical for all kinds of Bessemer-steel work.

The ingots arrive in the rail-mill at a dull red-heat on the outside, while the interior is at a much higher temperature. They are therefore placed in gas reheating-furnaces until at a uniform temperature, at which they can be easily worked. Following the course of one ingot, it is taken on a truck from the reheating-furnace to the rolls between which it is to be passed, and to emerge a long, perfectly shaped rail. The rolls are of cast-iron, and are in two sets, — the roughing-rolls and finishing-rolls. The first set consists of three rolls placed in a vertical row, and turning in a strong frame at each end. The ingot, or bloom as it is now called, is passed between the lower and middle rolls near one end, and is reduced in section, and lengthened. The platform on which it now rests is raised, and the bar is sent back between the middle and top rolls. The platform is lowered again; and, as it descends, a row of iron fingers, projecting up from beneath it, turns the bar, and moves it toward the middle of the rolls. Thus it is sent, through and up, back and down, moved from one end of the rolls to the other, being thereby reduced in section and correspondingly lengthened, until it finally leaves the roughing-rolls, having the approximate shape of a very large rail. As this bar goes through the roughing-rolls for the last time, another bloom is put on, and goes through for the first time at the other end of the rolls. Without a pause, the bar is carried along on revolving-rollers in a direct line to the finishing-rolls. These are two-high and reversing; being rotated first in one direction, and then in the other. The shape of the spaces between them is such that the last passage of the bar gives it the form and size of section required in the finished rail. After being sent through these rolls the necessary number of times, the finished rail-bar passes on in a direct line, as before, until it reaches a circular saw, which is swung up against it, and the rough or scrap end sawed off. The saw is swung to one side, and the bar moved along until the cut end comes against a stop-plate, which is at a distance equal to the length of one rail from the saw; and a slight motion of the saw cuts off the length. The stop-plate is swung to one side, and the rail is carried along to a large platform formed of rails laid at right angles to its direction. The rail is seized between a curved bar and a row of iron fingers which rise from beneath the platform or 'hot-bed,' and is bent. This is necessary in order that the rail shall be approximately straight when cold, as on account of the irregular shape of its section, if straight when hot, it would bend in cooling. After being bent, the rail is slid by the curved bar to either end of the hot-bed, where it is left to cool. When cool, any curves in its length are removed under a press; the rough edges left by the saw are removed with hammer, chisel, and file; the holes for the joints are drilled at both ends simultaneously; and it is loaded on a car close at hand, ready for shipment.

Each ingot makes four rails with two scrap-ends. The rail-bar, as it leaves the finishing-rolls, is thus about one hundred and twenty-two feet long. The weight of rail is regulated by adjusting the distance between the finishing-rolls, and gauging the length of the ingot in the mould. A different form of cross-section, of course, necessitates a change of finishing-rolls. From the time the ore is melted in the blast-furnace, until the rail is left on the hot-bed to cool, the temperature of the metal does not fall below that of a red-heat.

ARTHUR T. WOODS.

THE GEOLOGICAL RELATIVES OF KRAKATOA AND ITS LATE ERUPTION.

Topographische en geologische beschrijving van een gedeelte van Sumatra's westkust. Door R. D. M. VERBEEK. Batavia, *Landsdrukkerij* (Amsterdam, *Stemler*), 1883. 20 + 674 p. 8°. Atlas of maps, and portfolio of plates. [Our figures, 1, 2, are from this work, with slight alteration.]

Kort verslag over de uitbarsting van Krakatau op 26, 27, en 28 Augustus. Door R. D. M. VERBEEK. Batavia, *Landsdrukkerij*, 1884.

IT happens well, that, just after the attention of the scientific world is called to the Dutch East Indies by the eruption of last August, there should be published an important work on the geology of a part of Sumatra, in which the relations and structure of the great Javanese and Sumatran chain of volcanoes are described with much thoroughness. We must congratulate Mr. Verbeek on the opportune appearance of his volume and atlas on 'Sumatra's westkust,' as well as on his prompt action in gathering material for a history of the outburst of Krakatoa, of both of which we can give but too brief a mention in this notice.

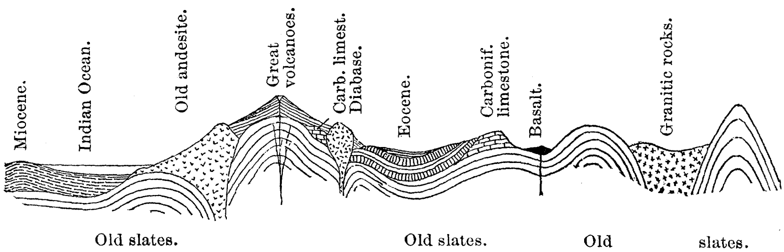
Introductory to these reports, one should read over K. Martin's review of the present knowledge of East-Indian geology,[1] which contains in an appendix a list of forty-seven publications on the subject; or the brief statements of the question by Verbeek himself that have been prepared for recent exhibitions;[2] and, in

[1] Die wichtigsten daten unserer geol. kenntniss vom niederländisch Ost-indischen Archipel. Bijdragen tot de taal-, land-, en volkenkunde van Neerlandsch-Indië, 1883.

[2] Descriptive catalogue of rocks, coal, and ores from the Dutch East-Indian Archipelago, prepared for the Melbourne international exhibition, 1880. (Batavia, Kolff.) Géologie des Indes néerlandaises, prepared for the international exhibition at Amsterdam, 1883.

the same connection, one should consult Verbeek's earlier report on southern Sumatra, which contains descriptions of Krakatoa itself before the eruption.[1]

Fig. 1 is taken from a series of generalized profiles illustrating the geological history of Sumatra. Archaean rocks are nowhere seen.



S.W. FIG. 1. N.E.

The oldest members of the series are non-fossiliferous slates and limestones, in places holding quartz veins that are sometimes auriferous, and cut by eruptives of the granitic group: these are overlaid by limestones, well proved to be of carboniferous age, cut by diabasic eruptives. Mesozoic strata are absent, implying a general elevation to a broad land-surface, followed in eocene time by depression again, during which workable coals were formed. There are other tertiary strata, such as the miocene beds of the small islands to the south-west, succeeded by broad quaternary deposits over the lowlands. The early tertiary eruptives (basalt and hornblende andesite) are relatively scarce, and are but dwarfs among the gigantic cones that have been heaped up since the end of tertiary time. These are chiefly augite andesite, mostly in the form of ashes and sand, holding larger blocks, but sometimes as dikes or lava-flows. They reach almost 3,000 metres altitude, flattening from a slope of 30° or 35° at the summit, to an almost level plain at the base, with a curve of descent that is shown to be closely logarithmic in its form. Krakatoa (here called Rakáta) is one of these cones, standing on the most south-eastern transverse group of the great range of Sumatran volcanoes, of which sixty-six are given in a list, and seven among them (not including Krakatoa) are marked active. A considerable share of attention is given to lithology; and on the atlas sheets, the different classes of eruptive rocks are distinguished. There are also special descriptions of the several craters formed successively about the great volcanic centres, — as on the summit of Merapi (fig. 2, ideal section), where four concentric walls, almost unbroken, stand one within the other, a gigantic cone-in-cone structure, — and also of the formation of volcanic lakes, from the small ones in the well-preserved craters, to the large basins of Maniendjoe (100 □ kilometres in area), the result of a central caving-in of a great volcano whose remains are seen in the surrounding Danan Gebergte, or Lake Mountains; and the still larger Singkarah (112 □ kilometres), formed by eccentric subsidence.

[1] Topographische en geologische beschrijving van Zuid-Sumatra. Door R. D. M. VERBEEK (215 p., with geological map, profiles, etc.); Jaarboek van het mijnwezen in nederlandsch Oost-Indië, 1°, 1881. Our figures, 5, 6, 8, are from this work.

The theory illustrated by von Hochstetter[1] is quoted to account for the mechanism of these changes. His figures are therefore here reproduced, with slight alteration, as of additional

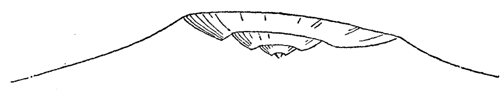


FIG. 2.

value from their acceptance by an observer practised in the study of volcanic phenomena on the largest scale. Fig. 3 shows the effect

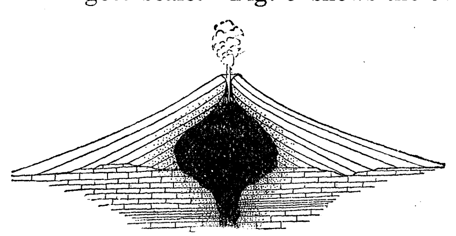


FIG. 3.

of continued eruption in melting the interior part of the cone previously formed: the volcano is here active. Fig. 4 shows the falling-

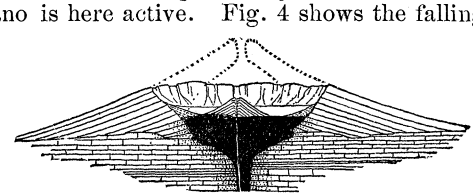


FIG. 4.

in of the cone when the molten interior is blown out, or allowed to sink, and, in this

[1] Ueber den inneren bau der vulkane. Neues jahrb., 1871, 469.

form, is applicable to the Oeloe-Danan volcano, shown in true proportions in fig. 5 (scale, 1: 20,000), or to Maniendjoe, and

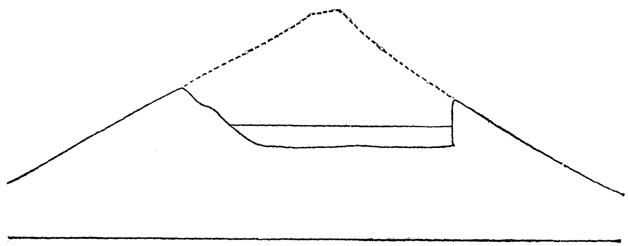


Fig. 5.

probably to Krakatoa: the volcano in this stage is dormant for a longer or shorter period. A renewal of eruptive action would build a new cone within the circular walls remaining from

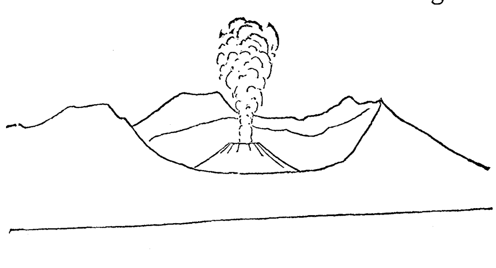


Fig. 6.

the old cone, like Vesuvius in Somma, or like the Vogelsang crater in the old Kaba cone, seen across the lower slope of the neighboring Tjoendoeng volcano in fig. 6: this has been three times repeated in Merapi, fig. 2. Finally, fig. 7 represents the molten interior, neither thrown out nor drained away, but allowed to stand and cool slowly into a solid crystalline mass, revealed in part by subsequent erosion: such a volcano is definitely extinct.

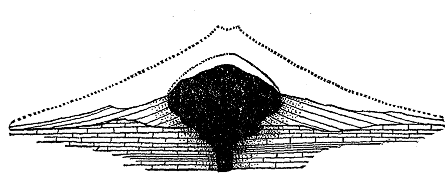


Fig. 7.

Mr. Verbeek shows himself to be one of the not very numerous geological writers who appreciate the needs of their readers. His reports open with brief abstracts of their results, from which these notes are in large part taken. On reading his abstracts, a general idea of the whole work is gained; then, by following the well-prepared table of contents, any special topic is easily discovered for closer study. The whole volume is very simply written, and well printed: it lacks only page-headings and index. The atlas sheets, on a scale of 1 :100,000, are prepared with satisfactory neatness; but their topography is not so expressive as one might wish, nor are the profiles near enough a natural scale: but, apart from this, the work is most creditable to the Dutch colonial department.

The preliminary report on the eruption of Krakatoa gives a brief account of the results of the author's seventeen-days' trip in the region of the disaster, combined with general records of other observers. It is dated Buitenzorg, Feb. 19, 1884. The knowledge of the island before the eruption is based on the English and Dutch surveys, whose outline-maps have of late been frequently reproduced, and on sketches by Buijsken in 1849, and the author in 1880 (fig. 8). The northern, lowest summit threw out pumice in 1680, and, after two centuries' rest, began work again in May, 1883, continuing with irregular activity till Danan, the middle summit, joined it in the

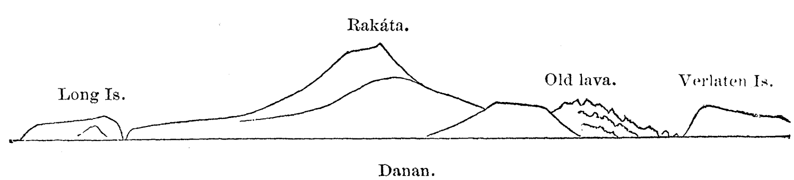


Fig. 8.—Krakatoa from the north.

great explosions of August. The original area was 33$\frac{1}{2}$ □ kilometres, of which 23 sank; leaving water 200 to 300 metres deep, except where a single rock rises 5 metres above the sea-surface. The remaining 10 □ kilometres — the background of fig. 8 — grew to 15$\frac{1}{2}$ by addition of ashes on the south and south-west. In the same way, Long Island increased from 2.9 to 3.2; and Verlaten (Deserted) Island, from 3.7 to 11.8 □ kilometres. All these accumulations were made of ashes and dust; for, although molten lava doubtless existed in the crater, there were no overflowing lava-streams. The greater share of the erupted material fell within 15 kilometres of the island,

where it attained depths of from 20 to 40 metres; rising even to 60 or 80 metres on the flanks of Rakáta (corrupted to Krakatau), the southern and highest part (822 metres) of the island. Fragments the size of a fist were thrown 40 kilometres from the volcano. Between Krakatoa and Sebesi, to the north, the ashes and pumice filled the sea at two points, forming low islands (Steers and Calmeijer), which have already been much broken and degraded by the waves. The sixteen little craters reported near where these islands stand have had no existence: they were only smoking heaps of ashes.

The precise hours of the heaviest explosions were not determined directly, but were based on the self-registering pressure-gauge of the gasometer in Batavia, as there was no self-registering barometer there. Making seven minutes allowance for the time of air-wave passage from the volcano to the gauge, the most violent eruptive action occurred at 5.35, 6.50, 10.5 (maximum), 10.55 A.M., Aug. 27, Batavia time. It was these air-shocks that were felt by barometers all around the world. In the May eruption, sounds were heard 230 to 270 kilometres; but in August the noise of the explosions was audible 3,300 kilometres from the island, or within a circle of 30° radius, equalling one-fifteenth of the earth's surface. The sounds spread irregularly; and it is suggested that the wind and the ashes in the air had much to do with the silence at points near which the eruption was distinctly heard. The eruption of Tomboro in 1815 was heard only half this distance; but the quantity of its ejected material (calculated from a correction of Junghuhn's data) was eight to eleven fold that thrown from Krakatau, which Verbeek determines to be close to 18 cubic kilometres. Two-thirds of this fell within 15 kilometres of its origin, as will be shown on an ashes-map, to be published in the final report. The ashes contain from sixty to seventy per cent of silica. Under the microscope, they show, 1°, glass in small, porous, irregular fragments; 2°, plagioclase felspar, with inclusions of glass, apatite, augite, and magnetite; 3°, pyroxene, probably rhombic as well as monoclinal, with inclusions of glass, apatite, and magnetite; 4°, magnetite in grains and octahedrons; this is the oldest component, and decreases in quantity on receding from the island. The great ten-o'clock wave, which it is thought resulted from the falling-in of the northern part of the island, following the most violent explosion, rose to heights of 30 and 35 metres on some of the neighboring coasts, and destroyed more than thirty-five thousand people. Maps, tables, and drawings are in preparation for a more detailed report; and this, in connection with the report we may expect from the sun-set committee of the Royal society, will form a most entertaining addition to the already interesting literature of volcanoes.

STOKES'S LECTURES ON LIGHT.

Burnett lectures on light. First course, on the nature of light. By GEORGE GABRIEL STOKES. London, *Macmillan*, 1884. 9+133 p. 24°.

THIS little book consists of lectures delivered at Aberdeen in November, 1883. They have their origin in an interesting manner, which is, perhaps, possible only in Great Britain. Just a century ago John Burnett, a merchant of Aberdeen, bequeathed a fund to establish prizes for theological essays. These prizes, a first and second, were to be competed for once in forty years; and awards have been made on two occasions since the foundation. In 1881, however, a new direction to the foundation was given by order of the secretary of state for the home department, in which it was provided that a lecturer should be appointed at intervals of five years, to hold office for three years. The subjects to be treated are, 1°, history; 2°, archeology; 3°, physical science; 4°, natural science. Professor Stokes was chosen as the first lecturer.

The lectures are unique, as far as our knowledge extends, in the effort to present the higher portions of optics without the employment of experimental demonstrations, diagrams, or mathematical language.

Whether the knowledge assumed in the reader, which does not include any thing of the theory or phenomena of interference, diffraction, double refraction, or polarization, is sufficient to enable him to understand every thing contained in the lectures, is problematical. But, at any rate, to those better equipped, the book gives a most concise and interesting review of the history of optics. A personal reminiscence of a conversation with Sir David Brewster (p. 15), the last great champion of the theory of emission, just after his return from Paris, where he had witnessed Foucault's crucial experiment regarding the velocity of light in air and in water, is highly interesting; for it shows us the singular motive which prevented even so acute a mind as Brewster's from yielding to overwhelming evidence: "he was staggered by the idea, *in limine*, of filling space with some substance merely in order

that 'that little twinkling star,' as he expressed himself, should be able to send its light to us."

Noteworthy is Professor Stokes's opinion (p. 83) of the astonishing conclusions of Young and Forbes as to the varying velocities of propagation of different wave-lengths in vacuum; for his doubts as to their validity seem founded only upon the fact that the conclusions depend upon the judgment of the eye of a single observer.

We shall await with interest the publication of the next year's course, which is to be devoted to researches in which light has been used as a means of investigation. The third year's course will "be assigned to light considered in relation to its beneficial effects."

NOURSE'S AMERICAN EXPLORATION IN THE ICE-ZONES.

American exploration in the ice-zones (etc.), prepared chiefly from official sources. By Prof. J. E. NOURSE, U.S.N. Boston, *Lothrop*, 1884. 3 + 578 p., illustr., maps. 8°.

THE work of Professor Nourse does not profess to be, and is not in any sense, a study of the results of arctic exploration performed by Americans, or of the relation of American explorations to explorations made by the people of other nations. It is simply a collection of narratives of the different expeditions, — gotten up, like the stock compilations, by hack-writers, — which are published on various subjects from time to time. It is a book undeserving of high praise, either in its contents or its make-up. The only thing which redeems it from perfect mediocrity is the fact that it contains some data in relation to the North Pacific exploring expedition, under Rodgers, the report of which still remains unpublished, and a few facts from Hooper's report of his voyage in the Corwin in 1881, the original of which has not been made public.

The record is complete only for the naval and military expeditions. Those of the telegraph explorers, 1865–68, are not even mentioned, though much of their work was in really arctic regions; and the indirect results of their explorations have added one-seventh of its area to the present United States, and have contributed at least one hundred titles to geographical bibliography. The travels of Kennicott and others in the Hudson-Bay region, of Nelson in northern Alaska, the work of the coast-survey in and north of Bering Strait in 1880, are left to other chroniclers. We presume this may be accounted for by the fact that the investigations referred to, and their value, are familiar only to students, specialists, and geographers, and not easy of access to the mere compiler.

From a literary point of view, the work is open to severe criticism. The thread of the narrative is frequently broken for the most trivial digressions, which are pursued at great length. The misprints are numerous, and generally of that objectionable kind which confuses the sense, without being obvious to the ordinary reader. Trifling matters are detailed at length, while more important ones are omitted.

In spite of all this, the book will be attractive to youthful readers who are not critics, and enjoy unfamiliar details, and to whom the really weightier matters are not important. It is fully illustrated by cuts drawn from Rink, Bessels, Hall, Hayes, and various government publications, and is accompanied by the worst map of the circumpolar regions which we have ever encountered.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

U. S. geological survey.

Paleontology. — Mr. C. D. Walcott has prepared the manuscript for a report on the St. John fauna of New Brunswick, contained in the Hartt collection. It is ready for publication as a bulletin of the survey, and only awaits the completion of the drawings illustrating it to go to press.

During April the collection of Devonian fossils from the Hamilton group of New York was transferred to the U. S. national museum, and recorded. The collection was made about Moravia, N.Y., by Mr. Cooper Curtice, during a portion of the field season of 1883. It also included a quantity of specimens collected by Mr. Curtice prior to his becoming a member of the geological survey. The collection consisted of fifteen hundred and seventy-seven specimens, containing sixty-two genera and a hundred and eighteen species.

Dr. C. A. White, during May, was occupied mainly with the examination of fossils forwarded from California by Mr. G. F. Becker, and in preparatory study for his proposed work in the mesozoic and cenozoic areas of California during the coming season. Dr. White started for California the 2d of June, and will probably take the field first in the Clear Lake region, and make a section towards the coast.

Mr. J. B. Marcou has about completed the sorting and arranging of the type specimens in the National museum, and will soon take the field. He will devote his time to the study of the mesozoic and tertiary formations along the Atlantic coast, especially in New Jersey, Maryland, and Virginia, and possibly in North Carolina, beginning in New Jersey.

Prof. L. C. Johnson has assorted and labelled all of his collections made last season, so as to show the localities from which they were obtained, and the geological horizons which they represent. He has now left for Mississippi, where he will begin to collect in the cretaceous and in the older tertiary.

Prof. William M. Fontaine is still engaged in the study, classification, and description of the fossil plants from the younger mesozoic strata, and in the preparation of drawings in illustration of his work.

Prof. H. S. Williams reports progress in his work of elaborating the material collected by him, and in writing his report upon the comparative study of the Devonian faunas of western New York.

U. S. signal-office.

The progress of tornado investigation.[1] — In the study of tornadoes it has become necessary to undertake something more than a simple record of their occurrence, or an occasional investigation of those that are attended with unusual destruction to life and property. A practical knowledge of the nature of these destructive storms is a matter of the utmost importance to the inhabitants of certain sections of the country; and not least among the objects aimed at by the chief signal-officer, in directing the continuance of tornado investigation, is to allay any needless anxiety or fear on the part of those people living in the regions most frequented by these storms. Methods of observation based on reports from stations situated from one hundred to two hundred miles apart, as in the case of cyclones and hurricanes, are inadequate to develop the mysteries of the funnel-shaped tornado-cloud.

As a consequence, therefore, a new plan was devised, based on the result of special investigations in 1882 and 1883, by means of which it is now sought to study more intimately the origin, character, frequency, and geographical distribution of tornadoes.

To inaugurate the details of the proposed system of work, it became necessary to establish a corps of observers, whose duty should be to report the occurrence of tornadoes, and make examinations of their paths and various phenomema; for which purpose special definite instructions are issued.

The observers are called tornado reporters, and now number about eight hundred. Their stations are mostly located in the states of Alabama, Georgia, South Carolina, North Carolina, Missouri, Arkansas, Kansas, Illinois, Indiana, Iowa, Nebraska, Wisconsin, and Minnesota. These are the states in which tornadoes are of most frequent occurrence: and this distribution limits our study to certain states, and even certain portions of a single state; for there are portions of some states that are frequently visited, and other portions seldom, if ever, visited by tornadoes. In the regions of greatest frequency the stations number from one to three in each county, depending upon its size.

Tornado reporters, in return for their voluntary contributions, are supplied with the tornado publications of the signal-service; they are also furnished with the material necessary for the proper record and mailing of observations and reports.

Reports are forwarded to the chief signal-officer as soon as possible after the occurrence of a tornado, and consist of detailed descriptions, instrumental observations, photographs, diagrams, charts, and illustrations.

While attention is mainly given to the examination and report of tonadoes for the current year, each reporter is instructed to work up the past history of these storms in his state, making careful search after any facts relating to windfalls, or other traces of past tornadoes. Some of the results sought to be attained by the above method of investigation may be briefly given as follows: 1°, to determine the origin of tornadoes, and their relation to other atmospheric phenomena; 2°, to determine the geographical distribution of tornadoes, and their relative frequency of occurrence in different states, and in different parts of the same state; 3°, to determine the conditions of formation with a view to the prediction of tornadoes; 4°, to determine the means of protection for life and property; 5°, to determine the periodicity of the occurrence of tornadoes, and their relative frequency by seasons, months, parts of month, and time of day; 6°, to determine the prevailing characteristics of tornadoes; 7°, to determine the relation of tornado regions to areas of barometric minimum.

A review of the past year gives the following as some of the principal results: —

1°. That there is a definite portion of an area of low pressure within which the conditions for the development of tornadoes is most favorable; and this has been called the 'dangerous octant.'

2°. That there is a definite relation between the position of tornado regions and the region of high contrasts in temperature, the former lying to the south and east.

3°. That there is a similar definite relation of position of tornado regions and the region of high contrasts in dew-point; the former being, as before, to the south and east.

4°. That the position of tornado regions is to the south and east of the region of high contrasts of cool northerly and warm southerly winds, — a rule that seems to follow from the preceding, and is of use when observations of temperature and dew-point are not accessible.

5°. The relation of tornado regions to the movement of upper and lower clouds has been studied, and good results are still hoped for.

6°. The study of the relation of tornado regions to the form of barometric depressions seems to show that tornadoes are more frequent when the major axis of the barometric troughs trend north and south,

[1] Communicated by permission of the chief signal-officer, U. S. army.

or north-east and south-west, than when they trend east and west.

7°. Tornado predictions have been made a matter of daily study since the 10th of March, 1884; and the average up to June 1 shows that it has been possible on fifty-five days to successfully predict from the morning weather-map that no tornado would occur on that day. On twenty-eight other days tornadoes were predicted for particular states or larger regions; and of them the tornadoes on seventeen days occurred in or near the specified region, while on eleven days tornadoes occurred in regions for which they were not predicted. JNO. P. FINLEY,

Sergeant signal-corps, U. S. army.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Trenton natural-history society.

June 10. — Mr. F. A. Lucas described the building-habits of some birds. The cat-bird seems indifferent as to locality, building ten feet from the ground, or quite as often in a tangle of weeds within eighteen inches of the surface. The song-sparrow's nest is small and delicate, resting on the ground, often in a slight depression, which makes it very inconspicuous. —— Dr. C. C. Abbott remarked on crayfish; also on a catfish new to the locality, and on field-mice. He had taken the meadow-mouse (Arvicola riparia) from a dead log, where it had hollowed a nest, lining it with hay and a few feathers; also from driftwood into which it had tunnelled. The food seems to be chiefly seeds, although it is probably carnivorous at times. Under the loose bark of decaying, prostrate trees, the white-footed mouse (Hesperomys leucopus) is occasionally found, although it usually makes a home in a thicket of briers or a deserted bird's nest. The favorite food is unfledged birds. They are much afraid of snakes. They beat a hasty retreat when a dead snake is placed near the nest; but when convinced, by cautious examination, that the intruder is harmless, they bravely devour it. —— Prof. A. C. Apgar remarked on some rare plants: Vicia Americana, Muhl., never before observed in New Jersey; Viola pubescens eriocarpa, Nutt., a western variety; Polemonium reptans, L., which had been removed from the Geological survey's preliminary catalogue of New-Jersey plants, under the supposition, that, being so remote from its usual habitat, it must have been incorrectly determined; Nuphar pumilum, Smith, and Struthiopteris Germanica, Willd., the last not having been previously observed in the state. —— Dr. A. C. Stokes communicated a paper on Tarantula arenicola Scudder, detailing its method of burrowing, of building the tower above the entrance, and of capturing food. Before the pit and tower are completed, the spider will seize food at some distance from the aperture: when finished, she leaps from the tower, and runs across the ground to take the selected victim. If within the burrow when an insect passes over the tower, or becomes entangled in the loose grass of which it is usually formed, the spider rushes to the top, and the insect, if acceptable, is seized. The towers are irregularly five-sided, and an inch or less high. The burrows are cylindrical, perpendicular, and vary in depth from eight to twenty inches; in diameter, from one-quarter to three-quarters of an inch.

Entomological society, Washington.

June 5. — Mr. George Marx read a composite paper on the geographical distribution of the Arachnidae of the United States, on the respiration of Epeira insularis, and biological notes on Latrodectes verecundus. The range of each family was pointed out in succession; and the colorational changes, dependent upon locality, were treated at some length. The speaker had noticed a true alternate opening and closing of the pulmonary stigmata of the Epeira, on taking it from a tight box in which it had been confined for some days. By a careful rearing of the Latrodectes, he had thrown together no less than ten species described by Abbott, which are now referable to the different stages of L. verecundus. —— Mr. E. A. Schwarz exhibited specimens of Ino immunda (Cucujidae) and Eleusis pallida (Staphylinidae), calling attention to the marvellous resemblance, which he stated could not be referred to mimicry for protective reasons, but must be considered accidental. —— Mr. L. O. Howard exhibited specimens of Inostemma Boscii (Proctotrupidae), and gave a short history of the theories concerning the curious thoracic appendage, arriving at the conclusion that it is a secondary sexual character. He also exhibited specimens of a new species of the genus Schizaspidia, collected in Florida by Mr. Schwarz, and which is also furnished with remarkable thoracic prolongations. —— Dr. W. S. Barnard read a short paper on the development of Gordius and Mermis, exhibiting a specimen observed to issue from Harpalus pennsylvanicus.

Brookville society of natural history, Indiana.

June 3. — Robert M. King presented a paper upon some studies of the land-shells of Indiana, showing differences in habits, food, and color of the shell. —— Aug. Diener gave a short paper upon the Luna moth, presenting the time of its appearance, and the length of periods of its several changes. —— E. R. Quick spoke at some length on the results of the trip of Alexander Wilson down the Ohio River in 1810, referring particularly to Wilson's advice concerning the opening of the Grave Creek mound, and to his labors in the neighborhood of Cincinnati, at the mouth of the Big Miami River, at what is now the town of Vevay in Switzerland county, this state, and in the neighborhood of Louisville, — all points of interest, because of their proximity to the field in which the society is working.

Biological society, Washington.

May 31.—Mr. James E. Benedict described the recent cruise of the steamer Albatross in the Gulf of Mexico and the Caribbean Sea, and exhibited some of the most remarkable objects collected.——Ensign E. E. Hayden, U.S.N., read a paper on a new method of figuring fossil leaves and other objects by the aid of photography, with a saving of time, and increase of accuracy; the method consisting of drawing in India ink, upon a silver-print photograph, the outline of the object to be figured, the defects of the photograph being supplied by the draughtsman through comparison with the specimen. The photograph is then dismissed, and a photo-engraving is made by the ordinary method from the black lines of the sketch which remains. In the discussion which followed, it was shown that this process was novel only in its successful application by the author to the illustration of fossil leaves.——Mr. J. A. Ryder spoke of the development of viviparous minnows, and particularly of Gambrusia patruelis B. & G. The young fish develop within the body of the female parent, and within the follicles in which the eggs themselves were developed. These follicles, which were covered with a rich network of fine capillary vessels, assumed the office of a respiratory apparatus, by which the gases were interchanged between the embryo and the parent fish. This follicle also acted as an egg-membrane, being actually perforated by a round opening, which the speaker termed the 'follicular pore,' and which was analogous to the micropyle of the ordinary fish-egg. The arrangement of the follicles of the ovary within the body of the female was described at some length, and the peculiar differences between the two sexes in the arrangement of the viscera were pointed out. The fibrous bands, which act as supports or stays to the basal portion of the anal fin of the male, which is modified as an intromittent organ, were also described. The great difference in the sizes of the sexes was also referred to, the female weighing over six times as much as the male. The speaker concluded by expressing his earnest desire to investigate the other known forms of viviparous fishes, such as the Embiotocoids of the west coast, the viviparous blenny, and other bony fishes which have this habit, and which, in his opinion, would throw considerable light upon some of the peculiar physiological processes involved in the viviparous methods of development.——Mr. Romyn Hitchcock exhibited a collection of Foraminifera belonging to the genus Lagena, and explained the relations between this genus and the Nodosarine group; these briefly being that Lagena may be taken as the type of the group, passing through various stages of complexity, through Nodosaria, and ending in Cristellaria as the most complete manifestation of its method of growth.

Natural-history society of New Brunswick, St. John.

May 6.—Mr. R. Chalmers read a paper on the history of the Grand Falls of the St. John River, explaining its origin and features. Like Niagara Falls, it was shown to be the result of geographical changes in the quaternary era, causing the damming-up of a more ancient channel, and the consequent erosion of a new one. Facts bearing upon the nature and rate of change were at the same time given.

June 4.—Mr. C. F. Matthew gave an account of the late meeting of the Royal society of Canada, in Ottawa, reviewing the papers read in the natural-history section, and especially remarking on the importance of Dr. G. M. Dawson's discovery of evidences of an interglacial era in the north-west.——Dr. L. Allison read a paper on the structure and habits of rhizopods, with special reference to local forms.

NOTES AND NEWS.

ONE of the best results of the polar exploration congress, held at Vienna in April, was a resolution that the observations of all the polar stations should be published not only in the language in which they were written, but in German, English, or French as well. Neumayer of Hamburg appealed to the congress for aid in his endeavors to make hydrographic charts of the South Atlantic Ocean. The chiefs of the different stations reported their observations. The scale adopted by the committee of the electrical exhibition of Paris, in 1881, was adopted as a basis for the observations of the intensity of the magnetic earth-currents. The end of the year 1885 was named for the conclusion of the work of the various stations.

—Prof. F. H. Snow of the University of Kansas reports, that although the month of May was one of the coldest on record, yet it was marked by an entire absence of frosts. The rainfall was ample, though less than the average.

—Prof. W. B. Scott is now on his way to Montana with the fourth scientific expedition from Princeton, with the object of exploring the Wahsatch eocene of Wyoming and Montana.

—Professor Mushketoff will be sent by the geological committee of the St. Petersburg academy of sciences to explore the Kalmuk steppe (between Volga, Don, and Manikh). Later in the season he will make a geological exploration of the celebrated mineral springs of Piotigozsk and vicinity (northern Caucasus). This study is to decide many important questions about their protection and improvement. These springs are under direct government administration from the beginning of this year, after a long lease to a contractor.

—*Nature* announces the call of Dr. Hugo Gyldén, director of the Stockholm observatory, to the professorship of practical astronomy at Göttingen.

—The forthcoming volume of the Encyclopaedia Britannica, the seventeenth, extending from MOT to ORM, will contain the following articles: Navigation, by Capt. H. A. Moriarty, R.N.; Nebular theory, by Dr. R. S. Ball, F.R.S.; Newton, by Mr. H. M. Taylor of Trinity college, Cambridge; Nitrogen, by Prof. W. Dittmar; Nitroglycerine, by Sir Frederick A. Abel; Numbers, by Prof. A. Cayley; Numerals, by Prof. W. Robertson Smith; Numismatics, by Mr. Reginald S. Poole; Nutrition, by Prof. A. Gamgee;

Observatory, by Dr. J. L. E. Dreyer of Armagh; Opium, by Mr. E. M. Holmes; Optics, by Lord Rayleigh; Orchids, by Dr. M. T. Masters; and Organ, by Prof. R. H. M. Bosanquet.

— At the meeting of the Royal astronomical society, May 9, Prof. C. Pritchard of Oxford read a paper on the proper motions of forty stars in the Pleiades, which he has determined from a comparison of Bessel's heliometer-measures with recent micrometric measures made at Oxford, and also with the positions determined ten years ago by Wolf at the Paris observatory. The existence of certain small proper motions of these stars in different directions is interpreted as indicating the mutual interference of a group of gravitating bodies. At the same meeting of the society, Dr. David Gill, her Majesty's astronomer at Cape Town, described the mounting of the great thirty-inch refractor now constructing at the shops of the Messrs. Repsold, at Hamburg, and which is to be set up this year at the Pulkowa observatory, near St. Petersburg. The tube of the telescope will be about fifty feet long; and the mechanical arrangements of the mounting will be so thorough and convenient in use, that a single assistant, sitting at the lower end of the polar axis, will be able to point the instrument accurately to any part of the heavens. A paper was likewise read by Mr. A. A. Common of Ealing, proposing the application of his method of relieving the friction in the axes of large instruments, to the polar axis of a large equatorial telescope. In his plan, somewhat similar to that of the Repsolds, the centre of flotation in a bath of mercury is vertically underneath the centre of gravity of the polar axis and telescope combined. The Repsolds employ, instead, a friction-roller under the centre of gravity to support the Pulkowa telescope.

— Dr. A. Berghaus has called attention in *Ausland* to the successful revival of the use of fibres derived from the nettle, as a material for spinning and weaving. That the common stinging nettle was formerly largely used in Germany to afford a material for the making of woven fabrics, is proved in an interesting manner by the fact that the old German name for muslin literally means 'nettle-cloth' (*nesseltuch*). Before the new material was introduced, the fabric most nearly corresponding to the new cloth must, undoubtedly, have been made from the nettle, and, as in many other cases, the name remained (at least for a time) after the thing was changed. But on the introduction of cotton from America, the nettle soon fell into neglect; and it was not till comparatively recent years that attention was again called to it. After the exhibition at Philadelphia, when the German manufacturers saw that they must do something to put themselves on an equal footing with rival nations, Professor Reuleaux, their representative in America, strongly advised them to pay more heed to the products of their own soil in order to make themselves less dependent on foreign supplies, and, among other plants suitable for the purpose, he reminded them of the nettle. An enterprising lady took the matter up practically, and, in the end, with the most gratifying success. She planted nettles on a part of her estate composed of poor stony ground, covered only with a thin layer of soil, and, at an agricultural exhibition held in the autumn of 1877, she was able to exhibit nettle-fibres in all stages of preparation up to yarn. This success convinced the unbelievers; and hundreds thereupon began to cultivate nettles, not only in Germany, but also in Switzerland, Belgium, Hungary, Poland, Sweden, Austria, and even in this country. Two years later the first German manufactory devoted to the new industry was opened at Dresden. The experiments made there at first were not altogether satisfactory; but, after repeated attempts, a yarn was produced which left nothing to be desired. In this manufactory the common nettle is used to some extent, but the best results are obtained by using the Chinese nettle, which yields a fine glossy yarn, of greater strength than the common nettle. The fibre is hence known as China grass.

— In the first number of the *Jahrbuch der Deutschen malakozoologischen gesellschaft* for 1884, Heynemann continues his studies of little-known genera of slugs. From an examination of the type-specimen, he shows that Aspidoporus of Fitzinger is founded on a malformed individual of Amalia carinata. The genera Urocyclus, Elisa, and Dendrolimax are also discussed. Brusina, in a paper on the Neritodontas of Dalmatia, indulges in a lively polemic with relation to some rather peculiar publications by Bourgnignat. Both papers are illustrated. In the accompanying *Nachrichtsblatt*, Simroth discusses the European and especially the German slugs, a group of the Pulmonates which has recently excited much interest. Simon and Boettger describe the land-shells of the Cottish Alps, and Kobelt describes some new operculated land-shells from the Philippine Islands.

— At the *séances* held during April by the Société française de physique, in the rooms of the observatory, the curious experiment of using a gloved hand as a telephone-receiver was exhibited. Fig. 1 shows the apparatus used, P and M being a battery and a microphone-transmitter in the main circuit; B, an induction-coil with the break-circuit closed; while P' is a battery, and R, ordinary holders for receiving a shock.

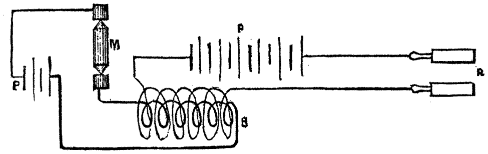


FIG. 1.

When two people, each with a gloved hand, take hold of the two holders with their bare hands, and one of them holds his gloved hand over the ear of the other, any conversation or music near the microphone becomes audible to this other; or, if they hold one another's ears, both may hear. By leaning their heads together, so that their ears would touch except for a sheet of paper placed between them, the same result was obtained. It was also found possible to do away

with the stretched membrane, the glove or paper, and for a third person to hear the conversation in the bare hands of the two holding the electrodes, when these two held his ears as shown in fig. 2. It has even been possible to render the sounds audible to a chain of people, each holding the ear of his neighbor.

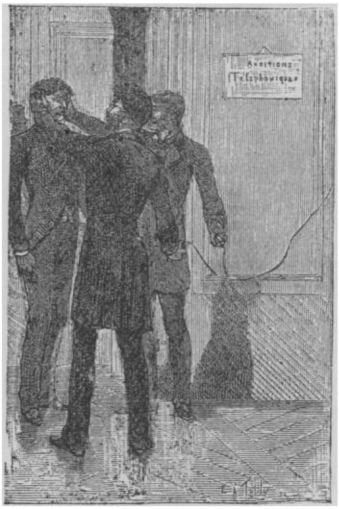


FIG. 2.

— In the report of the meeting of the Royal society of Canada, published in *Science* for June 6, it was stated that Mr. F. N. Gisborne had devised a new method of getting rid of the cross-talk in telephone cables. The device, that of the use of a metallic circuit of wires near one another, was patented by A. Graham Bell in England in 1877, and later in the United States.

— Dr. Palisa has had a declinograph, on the plan of Dr. Knorre's at Berlin, fitted to the twelve-inch Alvan Clark refractor at Vienna, and he is observing zones with even greater assiduity than usual. He reports himself as satisfied with the working of the instrument, which gives positions accurate to about $0^s.2$ and $2''$. In a zone 25^m by $20'$ a hundred and fifty stars can be registered. The positions are to be reduced to 1875.0, and this is chosen as the equinox for all the new Vienna maps. Each map is to have a catalogue of its stars accompanying it, which is an excellent addition. Dr. Peters's catalogue of sixty thousand zone stars would be of great usefulness, if it were available, as a supplement to his splendid series of celestial charts.

— Prof. W. Preyer of Jena is publishing a '*Specielle physiologie des embryo*' in four parts, of which the first two have appeared. It is written from a purely medical stand-point; for it discusses really human embryology, drawing upon mammals, birds, and other lower forms, for illustration. In spite, however, of its narrow scope and one-sided view, it is a valuable treatise. By the collation of the researches previously published, and the addition of some observations of his own, Preyer has compiled a work which reveals an extent of positive knowledge in this obscure field, which few would have anticipated. In the parts before us, the circulation, respiration, and nutrition of the embryo are very fully treated. The work is excellent, and, without doubt, will do much towards dispelling some of the crude and erroneous conceptions still prevalent in regard to the physiology of the mammalian embryo.

— The French geographical societies will hold their seventh general congress in the month of August at Toulouse. Geographers of several adjacent countries, especially of Spain, are expected to participate in the proceedings. The municipality has devoted a sum of twenty thousand francs to the expenses of the local committee, of which Dr. Ozenne is president, and Commander Blanchot, general secretary.

— An international fisheries, ornithological, and hunting-appliances exhibition is planned for 1886, in Vienna.

— A new expedition to Greenland has started from Copenhagen: it consists of Lieut. Jensen, Lorenzen as geologist, and the painter Rüs-Carstensen. The object of the expedition is the exploration of the west coast of Greenland between Holstensborg and Lukkertoppen. They expect to return in October.

— Prof. F. A. Forel of Morges reports that the glaciers of Mont Blanc, after decreasing for a considerable time, are now again advancing. Professor Forel has for many years recorded his observations on the Mer de Glace.

— A botanical section of the Cincinnati society of natural history was organized June 7, under the chairmanship of the curator of botany in the society. Its object was stated to be, to bring together those interested in the study of botany for the purposes of mutual encouragement and benefit, the investigation of the flora of the vicinity of Cincinnati, and the formation of a local herbarium. A number of specimens of plants were exhibited, and two or three new additions to the flora were announced. One of these was Matricaria discoidea, from near Loveland, O., — a very late introduction.

— There is no truth, the *Athenaeum* states, in the rumor that Mr. Herbert Spencer purposes paying a visit to Australia. His trip to the United States injured his health too seriously to induce him to try another experiment of a like kind on a much larger scale. Though still suffering from impaired health, he is happily able to devote a portion of his time to his favorite studies.

— Lieut. Frederick Schwatka, the arctic explorer, has resigned his position on Gen. Miles's staff, and will join his regiment in Arizona. The Russian geographical society has awarded its silver medal to Schwatka for his explorations.

— Dr. Griffiths sends to the *Chemical news* of March 7 a note on the formation of the recently discovered paraffine shale deposits of Servia, which he thinks coincides with the results of his other investigations. These deposits are situated on the River Golabara, in the western part of Servia. The shale occurs in upheaved cliffs about two hundred feet

above the surrounding plain. The formation consists of hundreds of layers of white and gray shale, one above the other, sometimes being separated by small beds of clay of a whitish color, containing rock-salt, and sodium and manganese sulphides. It is stated that this part of the country strongly resembles the paraffine and salt districts of Galicia. It has been known for ages that cattle and birds resorted to these cliffs to eat the clay containing the rock-salt, but the quality of the shale remained unknown until a year ago. The paraffine shale is entirely free from bituminous impurities, it is nearly white in color, and has no odor. When heated to about 800° F., it takes fire, and burns with a clear, bright, smokeless flame, leaving a gray ash behind. The deposits are of marine origin and eocene period. Eruptive porphyritic and trachytic rocks are plentiful at a distance of five or six miles. In the clay-beds (which are peculiarly free from ferric oxide) large numbers of the fossil remains of the eocene period are to be found. It is thought, that, in the limestone rocks which underlie these shale deposits, rock-salt and petroleum wells may be found. A sample of the paraffine shale yielded, on distillation, 2% of a semisolid hydrocarbon somewhat similar in appearance to ozocerite wax, which, on extraction with 'benzoline,' gave 1.75 % of wax. It also contains 3.02 % of water of combination, and 1.18 % of ammonia; the remaining ingredients being mineral constituents. It is stated that the mineral constituents of these paraffine shale deposits would make a useful hydro-cement, and could easily be obtained by open quarrying: they could be used as fuel with gas-retorts. They lie within easy reach of the Danube.

— The death is announced of Sir Sidney Smith Saunders, a leading English entomologist, who had made the Strepsiptera — a curious group of minute beetles parasitic on Hymenoptera — his special study.

— The medical congress in Berlin, in April, was very well attended, and most of the prominent medical questions of the day were discussed. The meeting opened with a paper on true pneumonia, which Professor Jürgensen considered infectious. Very opposite opinions were expressed during the discussion. Reflex action, and vaccination, followed. On the second day, diphtheria was the subject most discussed, which Dr. Löffles considered to be a local affection, caused by a chemical poison; but the theory found an opponent in Dr. Heubner of Leipzig. Professor Weber of London read a paper on school hygiene in England, and recommended medical inspection of schools. Nervous dyspepsia, and other nervous affections, filled up the rest of the discussions. Professor Rosbach of Jena read the report of the commission on the treatment of infectious diseases. Next year the congress will be held at Wiesbaden.

— As is well known, the work of excavating in the Tigris-Euphrates valley, the seat of the old Babylonian-Assyrian empire, has been carried on vigorously for the last forty years, and a vast mass of material has been collected and brought to Europe. Many thousand historical and commercial inscriptions, copies of ancient epic poems, magic rules and formulas, religious hymns, and specimens of architecture and sculpture, are now to be found in the museums of London, Paris, and Berlin. The most of this work has been done by the English. The cuneiform collection in the British museum is by far the richest in the world. Mr. Rassam, a wealthy Syrian gentleman of London, is now devoting all his time to excavating: he goes out every year, and brings back to England a larger or smaller quantity of tablets and other Assyrian remains. Already there is enough Assyrian material in the British museum to occupy scholars for the next fifty years. But the field is large; and there is room for other exploring parties, without danger of encroaching on the English domain. American Assyriologists have for some time felt the desirableness of having a collection of cuneiform material in this country; and last autumn some gentlemen interested in the matter held a conference, and determined to make the attempt to organize an expedition to Mesopotamia. It was thought best that the first attempt should be in the way of exploration and survey of the ground, in order to fix on the best points of work, and come to an understanding with the English parties now in the field. In spite of some unfavorable conditions, the preliminary arrangements have now been completed. The money is assured, Miss C. L. Wolfe of New York having given the whole of the sum which it was computed would be required. In accordance with her desire, the expedition will be called, in honor of her father's memory, 'the Wolfe expedition;' and this name will be, in the feeling of the public concerned, a no less fitting tribute to her most praiseworthy liberality. The gentlemen who have been selected to go out are Messrs. W. H. Ward, editor of the *New-York independent*, and J. T. Clarke and J. R. S. Sterrett, lately of the Assos expedition, — all proved men. The expedition has received the indorsement of the Archeological institute of America, in whose name it will go out. The department of state has promised to use its influence to procure the necessary firman from the Ottoman government. The purpose is to try southern Mesopotamia, the old Babylonia, the seat of the oldest civilization, and the portion of the country which has been less explored than any other. It is believed that here, and in the opposite region across the Tigris, there is probably abundance of early material. If this preliminary expedition should report favorably on its return, an effort will then be made to organize an excavating party immediately, and begin serious work. In the region had in view there are not only Babylonian-Assyrian, but also more modern Arabic and Syriac treasures to be hoped for; and the explorers will be instructed to gather all that they can find. The present expectation is that Dr. Ward will sail for England about September next. In London he will find Mr. Clarke, who is engaged in working up his Assos report; and the two will be joined by Dr. Sterrett, who is now in Athens, where, during the sickness of Professor Packard, he has been in charge of the American school of classical studies.